New Hampshire Energy Facts, 2002

Governor's Office of Energy and Community Services

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New Hampshire Energy Facts, 2002

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Photography

Applied Power Corporation, p. 3; Bill Burtis: title page (power plant, water, foliage), pp 4, 5, 10, 11, 13, 15, 17; NHDTTD/Bob Grant, table of contents; Green Mountain Power Corporation, title page (turbine); Warren Gretz, front cover (sky and field, farmer, sunburst), pp 14 and 16; NHDTTD/Robert Kozlow, front cover (clouds); Bill Timmerman, front cover (solar disk array); Robb Williamson, front cover (panels); pp 12; back cover.

Energy: A Central Factor in our Lives

This booklet is designed to help foster an understanding of New Hampshire's use of energy and the economic and environmental implications of that demand. By providing statistical insight into how much and what types of energy we use for different purposes in New Hampshire, *New Hampshire Energy Facts* gives policy makers, state agencies and businesses in New Hampshire the baseline information they need to make well-informed decisions about issues affecting energy production and use.

Most of the information is from the U. S. Energy Information Administration (EIA), a division within the federal Department of Energy. The information in this publication is from 1999, since that is the most current complete data the EIA has to offer. Because EIA gathers facts from states, utilities, fuel companies and other sources across the country, there is a significant time lag in having all the data in statistically valid form.

Where possible, the most current New Hampshire information available is presented. For instance, we felt it important to include updated information on electric generation in the state because two new, large commercial generating stations are slated to come on line as this publication goes to press.

Dates for different statistics in all portions of this report vary, depending on the most recent date for which data are available. All quantities are estimates or approximations.

CURRENT STATE OVERVIEW

Based on 2000 census data, New Hampshire is 41st in population in the United States, and, based on 1999 EIA data, the state is 45th in the amount of energy consumed, indicating that New Hampshire consumes slightly less per person than the rest of the nation.

The cost of energy is an important factor in New Hampshire's economy, in part because we pay more for energy than many of our fellow Americans: In 1999, New Hampshire ranked sixth highest nationally for the cost of one million Btus, and its rank for dollars spent on energy per capita was 19th. These rankings are attributable mainly to the high cost of transportation and heating fuels in the Northeast.

But recent reductions in electric rates in New Hampshire will have a positive effect on those rankings. Other factors positively influencing the cost per Btu and cost per capita are energy efficiency programs and technologies that are being instituted in homes, businesses, schools and municipal and state buildings throughout the Granite State. The increased use of native, renewable energy sources and more fuel-efficient vehicles also has the potential to improve New Hampshire's energy-cost position in the long term.

New Hampshire Demographics

US population, 2000 census:	281.4 million
NH population, 2000 census:	1,235,000
NH population size, national rank:	41st
NH population as % of national:	0.44% (i.e., just under 1/2 of one percent)
NH population, 1990 census:	1,109,252
NH population growth, 1990-2000:	11.4%
U.S. population growth , 1990-2000:	13.1%
NH households:	547,024 housing units
Source: US Census Bureau web site	

State Energy Consumption and Cost, 1999, and Comparison with Other States

Energy consumed, Btu, 1999:	335.4 trillion (335.4 TBtu)
Energy consumed, Btu, 1990:	270.8 trillion (270.8 TBtu)
Growth in consumption:	19.3% (64.6 TBtu)
National rank for energy consumed:	45th
Dollars spent for energy	
Nominal[2] dollars per million Btu:	$11.05
National rank:	6th
Total nominal dollars for energy:	$2,631,100,000
National rank:	40th
Gross State Product (GSP):	$44,229,000,000
GSP per capita:	$36,823
Efficiency, (Btu/$GSP):	7,573 Btu
Efficiency, GSP Dollars/TBtu:	$132,000,000
US average efficiency, GSP Dollars/TBtu:	$98,000,000

Per Capita Energy Data

Total Energy consumed, Btu:	335.4 TBtu
Population of State:	1,235,000
Energy consumed *per capita* (Btu/person):	279,236,122
National rank:	41st
Energy cost, nominal dollars total:	$2,631,100,000
Energy cost, *per capita:*	$2,190
National Rank:	19th

*Most of the data sets in this document are from 1999, the most recent year for which complete data are available. Where possible, more recent information is presented when it will not skew comparisons with 1999 figures.
2. Dollars which have not been adjusted to account for changes in purchasing power/inflation.

Efficiency, Security, Competitiveness, and Success

The axiom that the cheapest and least polluting unit of energy is the one you don't use has prompted a growing trend in energy-efficiency and energy conservation in business, industry, homes, schools, and public buildings.

In New Hampshire, five programs span this spectrum, helping homeowners, cities, towns, school districts, and business and industry to cut their energy use in order to save money and reduce pollution.

In State Government—

Governor Jeanne Shaheen started the **Building Energy Conservation Initiative** (BECI) as one of her first acts in office in 1997, taking advantage of legislation passed in 1993. BECI is charged with making energy—and resource-conservation upgrades to some 500 State buildings, with a potential energy savings of $4 million annually. Using a unique "paid from savings" approach, BECI makes possible new lighting, windows, and updated heating, cooling, air-handling and building-control systems without the investment of any capital funds. The loan covering the cost of the work performed is paid over ten years from energy, sewer, and water cost savings. The result is buildings that have lower deferred maintenance costs, use less water and energy, are more pleasant places in which to work, and result in less air pollution. In fact, the projected reduction in CO_2 emissions under the program is equivalent to taking up to 4,800 cars off the road each year.

In business and industry—

New Hampshire Industries of the Future (NHIOF) is a U. S. Department of Energy-sponsored partnership between businesses, the Business and Industry Association's WasteCap Resource Conservation Network, and the Governor's Office of Energy and Community Services. NHIOF is designed to help energy- and waste-intensive industries use technology and process advancements to improve profitability and competitiveness by cutting energy costs. NHIOF is helping manufacturers in some of the state's largest industry sectors—metals, rubber and plastics, and forest products—to develop strategies to resolve issues of energy efficiency, productivity, waste reduction and environmental conservation.

In cities, towns and schools—

Rebuild NH works with public and private entities, providing information and technical assistance to help them build and renovate facilities that will be energy efficient, reduce pollution, and save money. Since 1999, $381,315 in Rebuild grants has helped complete about $9.3 million in projects in 32 communities, involving 123 local and state-owned buildings. Rebuild NH has also begun making available trained individuals to identify energy efficiency opportunities and direct energy efficiency projects that will save money and stimulate economic growth. Over the last two years, K-12 schools have become Rebuild NH's highest priority, because high-performance schools not only save money for schools by reducing energy use, they also enhance the learning environment, making students and teachers more productive and successful.

In low-income residences—

The State of New Hampshire's **Weatherization Program** is designed to provide services to low-income persons throughout the state, reducing their household energy use and costs by improving the energy efficiency of participants' homes. The overall goal of the Weatherization Program is to serve those low-income households that are most vulnerable to high energy costs and which do not have the means of making cost-effective energy conservation improvements to their homes.

In New Hampshire—

Electric customers, both residential and commercial and industrial, can take advantage of **NHsaves**, a $19-million energy efficiency program offered by the state's electric distribution utilities. A product of the restructuring of New Hampshire's electric industry, the energy efficiency programs are offered to customers of Public Service of New Hampshire, the New Hampshire Electric Cooperative, Unitil, Granite State Electric Company, and the Connecticut Valley Electric Company. The programs offer coupons, rebates, free audits, and other incentives to help both homeowners and business owners achieve energy efficiency, reducing their electric costs and air pollution. Utility estimates indicate that the programs, when fully implemented, have the potential to reduce electric use in New Hampshire by more than 704.7 megaWatt hours, removing 522.8 tons of CO_2, more than three tons of sulfur dioxide, and 1,830 pounds of nitrogen oxides from New Hampshire's air annually.

STATE DETAILS

New Hampshire generates more electricity (16.2 million megaWatt hours in 1999) annually than it uses (11.5 million MWh)—making it an exporter of electricity (4,689,000 MWh, or 28.9 percent of generation); but the vast majority of the fuels used to generate the energy consumed in the state is imported. In the chart at right, $1.6 billion is for imported fuels and represents money moving out of state for uranium, oil, natural gas, coal or some other non-wood, usually fossil-based, source.

The "native energy" generated in 1999 using wood and wood waste (31.0 trillion Btus from 1.3 million tons of wood chips and saw-mill residue costing $24.3 million) and most hydroelectric power (1.4 million megaWatt hours generated, for which the "fuel" is free) is also renewable energy.

Annual Total State Energy Consumption in 1999, Primary Energy Sources

Petroleum-derived energy—whether it is fuels for transportation or home heating—dominates the New Hampshire energy picture, constituting more than 54 percent of the energy used in the state, and more than 84 percent of energy costs.

Motor gasoline is responsible for nearly half the state's energy consumption costs, followed closely by the petroleum distillate used as both #2 heating oil and diesel fuel for transportation. Together, these two fuel sources comprise 69 percent of the cost and 40 percent of the Btus consumed in the state.

Coal is the fourth largest source of energy in the state, primarily because of its use in electric generation, followed by wood. On the cost side, however, natural gas is third, while propane is fourth in overall costs, though only 10th in its Btu contribution.

New Hampshire Energy Consumption, 1999

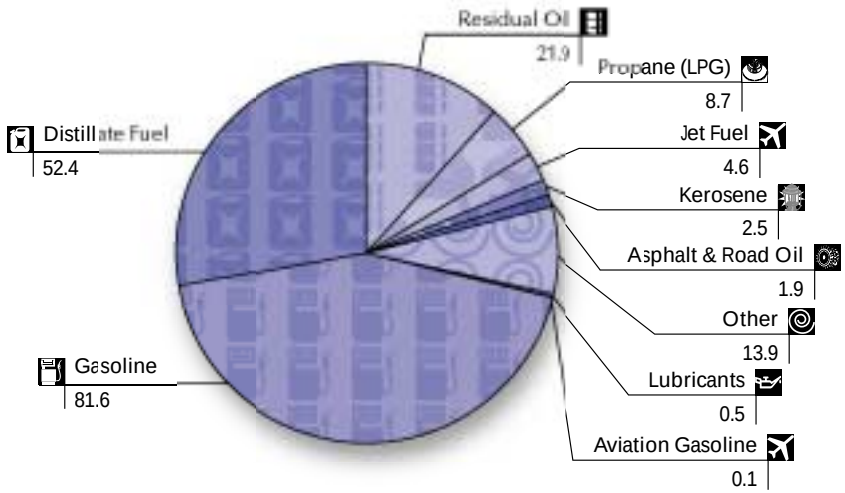
Fuel Type	Quantity (Various Units)	Heat Equiv. (TBtu)	%	Fuel Type[1]	Total Cost, $ Million	%
Uranium (Nuclear Electric Power)	8,676,000 MWh	92.2	27.5	N	45.6	2.8
Motor Gasoline	15,659,000 barrels (bbl)	81.6	24.3	F,P	791.8	48.8
Distillate[2]	9,000,000 bbl	52.4	15.6	F,P	320.1	19.7
diesel (on road)	2,734,000 bbl	15.9	4.7			
#2 heating oil	6,266,000 bbl	36.5	10.9			
Coal	1,344,000 tons	35.3	10.5	F	53.6	3.3
Wood and Wood Waste	various units[3]	31.0	9.2	R,B	24.3	1.4
Hydroelectric Power	2,368,000 MWh	24.5	7.3	R	0	0
Residual Fuel (e.g., #6 oil)	3,491,000 bbl	21.9	6.5	F,P	47.0	2.9
Natural Gas	20,000,000,000 cu.ft.	20.5	6.1	F	128.9	7.9
Other Petroleum[4]	2,591,000 bbl	13.9	4.1	F,P	52.3	3.2
LPG (propane)	2,407,000 bbl	8.7	2.6	F,P[5]	103.3	6.4
Jet fuel	820,000 bbl	4.6	1.4	F,P	19.8	1.2
Kerosene	437,000 bbl	2.5	0.7	F,P	16.3	1.0
Asphalt & Road Oil	288,000 bbl	1.9	0.6	F,P	8.2	<0.5
Other nonpetroleum[6]	N/A	1.9	0.6	R	0	—
Lubricants	88,000 bbl	0.5	0.1	F,P	9	0.6
Aviation Gasoline	28,000 bbl	0.1	0.03	F,P	1.2	0.1
Net electric losses[7] and exported electricity	-18,778,000 MWh	-64.1	-19.1	N/A		
TOTAL	**N/A**	**335.4**[8]	**100**	**N/A**	**$1,621.4**[9]	**100**

1. F=fossil P=derived from petroleum R= renewable B=biomass N=nuclear
2. EIA does not distinguish the two; total cost is combined.
3. EIA data do not specify the units. Tons of wood burned at NH Wood-Fired Power Plants, 1999: 1,316,011; 97% was from whole-tree chips and saw mill residue (Source: NHDES, cited in Phase I of low grade wood study; see pp 6 & 7).
4. Sixteen petroleum products in the industrial sector. Cost figure includes kerosene as well, which is not broken out by Energy Information Administration.
5. About half of domestic propane is separated from natural gas stream, half is a byproduct of gasoline production; EIA considers it 100% petroleum.
6. Geothermal, wind, photovoltaic and solar thermal energy.
7. Losses are primarily in transmission and average approximately 10% nationwide.
8. Columns do not add up to total due to independent rounding in EIA data.
9. EIA methodology, especially in accounting for electric utility fuel costs and electricity purchased by end users, precludes summing these figures to reach the total cost of $2,631.1 million. This table should be used only for comparison of different energy sources. For example, the cost breakdown does not include cost of electricity to end users. Cost of electricity to end users is $1,147 million.

Total Energy Consumption 1999, by Fuel Type

Type	Qty. TBtu
Petroleum	188.3
Nuclear electricity	92.2
Coal	35.3
Wood and wood waste	31.0
Hydroelectricity	24.5
Natural gas	20.5
Export & loss	-64.1

Total Petroleum Consumption in 1999 by Type, in TBtus



State Electricity Production, Consumption and Export

New Hampshire is part of the Northeast Power Pool (NEPOOL), operated by ISO-New England, Inc., an organization established by utilities to manage power supply and distribution over the regional New England power grid.

Electric generating plants in New Hampshire produced in 1999 more electricity than the state consumed, resulting in nearly 30 percent (4.69 megaWatt hours [MWh]) of the power generated here being exported from the state.

As the table and charts on page 9 indicate, the generating capability of Seabrook Station has made nuclear the leading type of electric generation in the state since it came on line in 1986. However, two new natural gas-fired power plants—one in Londonderry and one in Newington—will elevate natural gas to the top of New Hampshire's generating capability list, with 1,253 megaWatts (MW). (See projected capability, p.9).

Newer generating plants have increased in efficiency over the years. This is important because electricity is energy that has been converted from other energy sources; thus it is a *secondary* energy source. Since conversions are always less than 100% efficient, a given amount of electricity consumed represents a larger energy consumption to produce it—typically more than twice as much and up to three times as much. For example, a typical power plant using a steam turbine to drive an electric generator has an efficiency no better than about 35%. So only a third of the energy of the fuel producing the steam for the turbine is used, while two-thirds is lost as heat. More efficiency means generating more electricity with less fuel, thus reducing pollution.

New England Generating Capability, 1999

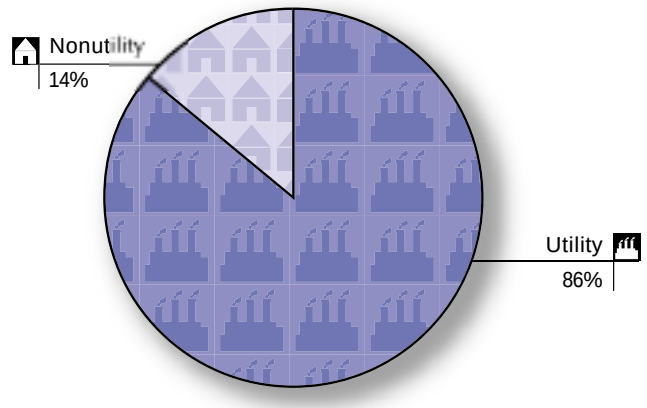
New England Grid's average generating capability:	27,600 MW
NEPOOL projected power output, 2002:	130,240,000 MWh
Record power demand:	25,384 MW[1]
New Hampshire peak (summer) actual demand, 2002:	2,127 MW[1]
New Hampshire peak (summer) generating capability:	2,851 MW
New Hampshire projected power output, 2002:	10,045,000 MWh
New Hampshire projected avg. power output/day, 2002: (2002 projections from ISO-NE, 3/02)	27,450.5 MWh

[1]Aug. 14, 2002

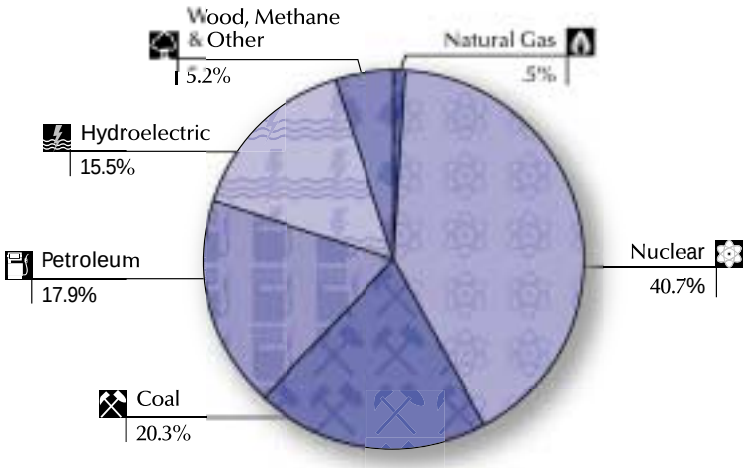
Electricity Production in New Hampshire, 1999

NH Net Electricity Production	MWh	%
Utility	13,875,659	85.6
Non-Utility	2,330,264	14.4
Total	16,205,923	100
Net Import (Export)	4,689,000	(28.9)

New Hampshire Electric Generation by Utility and Nonutility, 1999



Percent of Generating Capability by Fuel, 1999

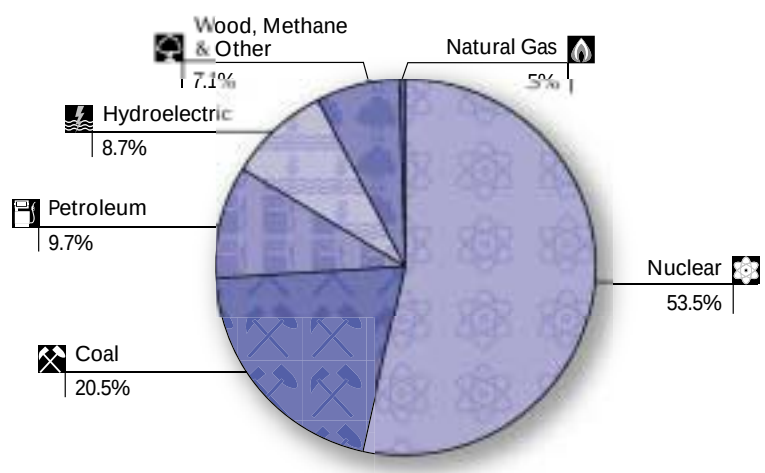


Total Electric Generating Capability and Actual Generation, 1999

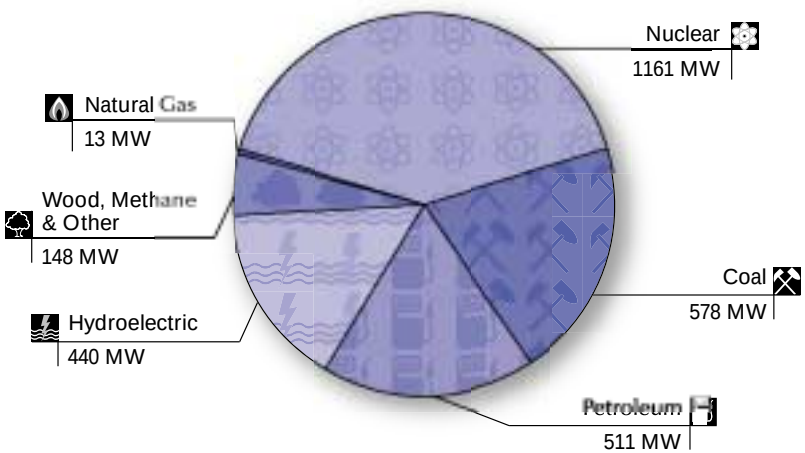
Source	Capability, MW	Capability, %	Generation, MWh	Generation, %
Nuclear	1161	40.7	8,676,237	53.5
Coal	578	20.3	3,328,263	20.5
Petroleum	511	17.9	1,572,633	9.7
Hydroelectric	440	15.5	1,411,282	8.7
Other (Wood, LFG, MSW)	148	5.2	1,142,637	7.1
Natural gas	13	0.5	74,872	0.5
TOTAL	**2851**	**100**	**16,205,923**	**100**

Note: The chart above uses summer generation capability. Actual generation capability varies seasonally. This is because the amount of work obtainable from a heat engine is greater in winter, when air and water are colder.
It is possible for the percent of actual generation for a particular fuel to exceed the percent capability of that fuel (e.g., nuclear) because another fuel is not used to its full capability for reasons of cost and/or availability. For instance, a nuclear plant will operate more than a hydroelectric plant because of seasonal water flows, and coal plants will provide more of the electricity available on the grid than petroleum plants because of fuel cost.

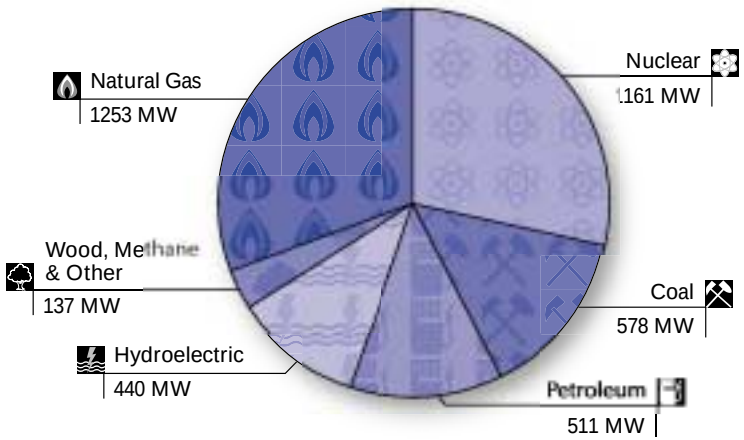
Percent of Actual Generation by Fuel, 1999



MegaWatt Generating Capability by Fuel, 1999



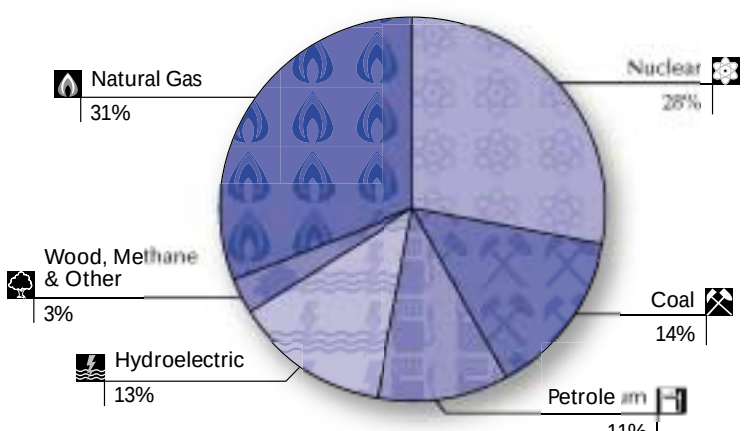
MegaWatt Generating Capability by Fuel, Projected, 2003



Total Electric Generating Capability in New Hampshire, Projected for 2003

Type of Information	Summer Generation Capability, MW	Other Notes
EIA 1999 total capability	**2851**	Most recent year for complete data available
Loss of BioEnergy plant	-12.2	
Additions to natural gas generation capability	+520 +720	Newington (Con Ed) AES Granite Ridge, Londonderry
Total, end of 2002	**4080**	Nearest whole MW
Difference, MW	+1228.6	
Difference, percent	+43.1	

Percent of Generating Capability by Fuel, Projected, 2003



Renewable Energy In New Hampshire

Renewable energy, in the form of biomass, landfill gas (LFG), municipal solid waste (MSW), and hydropower, is an important part of the energy mix in New Hampshire. Current renewable resources are described at right. In addition, there is the potential for such additional renewable sources as wind, solar—particularly for residential water heating—and bio-oil, a wood derivative with potentially important implications for maintaining the sustainability of the forest products industry.

New Hampshire's 1999 consumption of hydroelectric power (2.36 million megaWatt hours) exceeds its generation (1.41 million megaWatt hours) because of imports to the New England regional grid—from which New Hampshire takes its electricity—from such sources as Hydro Quebec.

*Renewable Biomass Energy Electric Generation Facilities, 1999**

Facilities:

- 6 wood-fired power plants (5 in 2002)
- 3 landfill gas (LFG)-fired facilities
- 2 municipal solid waste (MSW)-fired power plants

Total summer generation capability from biomass:	121.5 MW
Percentage of state electric generating capability:	4.3%
Net summer generation capability, wood:	103.1 MW
Percentage of state electric generating capability:	3.6%
Fuel consumed annually, tons of wood chips:	1.3 million
Net summer generation capability, LFG:	12.8 MW
Percentage of state electric generating capability:	0.45%
Net summer generation capability, MSW:	17.8 MW
Percentage of state electric generating capability:	0.62%

Renewable Hydroelectric Power Generation Facilities, 1999

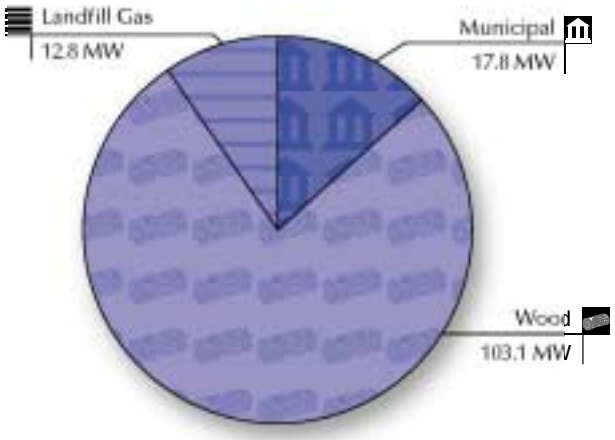
Utility-owned hydro generation sites	9
Percent of total state generating capability	2.3%
Net summer generation capability	64.3 MW
Non-utility owned hydro generation sites	27
Percent of total state generating capability	13.2%
Net summer generation capability	376.1 MW

Together, the 36 hydropower generating plants in New Hampshire have a capability of 440 MW, 15.5% of total generating capability in NH.

* Original numbers are for 1999. Closure of one wood-fired power plant subtracts 12.2 MW from the base 2851 MW, resulting in a summer 2002 base of 2838.8 MW. Percents remain the same.

There are currently no commercial photovoltaic or wind-powered electricity generating facilities in New Hampshire.

Biomass-Powered Electric Generating Capability, 1999



Renewable Energy Incentives

New Hampshire has an incentive, in the form of an exemption from municipal property taxes, for new installations of solar power systems, wind power systems and wood-fired central heating systems. Of 223 municipalities in the state, 58 had elected to permit exemptions for one or more of these types of systems as of 2000, when 682 homeowners had received exemptions totaling over $2.9 million.

Total systems receiving exemptions as of 2000:

Solar 462

Wind 2

Wood 218

In addition, state law (NHRS 477:49-51) establishes elective solar easements to guarantee access to sunlight for qualifying solar installations.

Energy Efficiency Programs

New Hampshire's electric distribution utilities offer a range of energy efficiency programs to residential, commercial, and industrial customers. The programs are funded by rate payers by way of a "system benefit charge" (SBC). This fee, assessed on each kilowatt-hour of electricity sold by a utility, is collected by the utility and used to fund the programs. Consumers can visit www.nhsaves.com or call 1-877-nhsave3 for detailed information.

SECTOR ENERGY DATA

Reviewing the data on energy use by economic sector below reveals the most about how New Hampshire uses energy and how effective that use is. For instance, it is immediately evident that the industrial sector, though it consumes nearly 30 percent of the total Btus, pays just slightly more than 14 percent of the total cost of all the energy used in the state.

Reviewing the chart on industrial energy consumption on page 13 explains why: more than a third of industry's Btus come from wood, which accounts for only 5 percent of the total energy cost.

Both the commercial (11.6%) and residential (21.3%) sectors spend significantly more for their Btus, representing 20 and 30 percent, respectively, of the total cost. This is because they obtain more of their energy from more costly fuels.

Economic Sector Comparison, 1999

Sector	TBtu	% total	$ Million	% total
Commercial	31.2	11.6	522.6	19.9
Industrial	80.0	29.8	375.8	14.3
Residential	57.4	21.3	798.4	30.3
Transportation	100.5	37.4	934.2	35.5
Total[1]	**269.1**	**100**	**2631.00**	**100**

[1] The difference of 66.3 TBtus between Sectors Total of 269.1 and the State Total of 335.4 (see page 6) is due to electrical losses, such as transmission and distribution line losses that are not apportioned to sectors.

Reducing the Load—Industries of the Future

Helping New Hampshire businesses reduce energy use and cost in order to be more competitive in the national and global marketplace is the role of New Hampshire Industries of the Future (NHIOF), a federally sponsored partnership between businesses, the Business and Industry Association's WasteCap Resource Conservation Network, and the Governor's Office of Energy & Community Services.

NHIOF is designed to help energy- and waste-intensive industries use advances in technology and process improvements to enhance their competitiveness and improve profitability. NHIOF is helping manufacturers in several of the state's largest industry sectors—metals, rubber and plastics, and forest products—to develop pragmatic strategies to resolve issues of energy efficiency, productivity, waste reduction and environmental conservation.

The charts on this and the following page show that more than 72 percent of the energy cost for New Hampshire businesses is in electricity. Using information gathered in energy audits made possible through the IOF program, participating industries have been able to take a variety of steps to lower electric use and costs. Some have installed highly efficient new lighting; others have replaced older, less efficient motors. Process changes suggested after technical assistance arranged by IOF have resulted in dramatic energy and resource savings. One New Hampshire manufacturer even began generating electricity using a gas-turbine generator and using the exhaust heat to produce process steam.

These and other changes made possible by the IOF program have begun to make New Hampshire businesses more competitive, more efficient, and more profitable. They have also reduced air and water pollution.

Commercial

This sector comprises the service-providing facilities and equipment of businesses, governments, institutional living quarters, and public and private civic, religious, and non-profit social service organizations.

Commercial Energy Consumption, 1999

Fuel Type	Quantity	TBtu	%	$Million	%
Electricity	3,732 Million kWh	12.7	40.6	419.1	80.2
Distillate (#2 and diesel)	1,142,000 bbl	8.4	26.8	37.3	7.1
Natural Gas	7 bcf	7.3	23.3	49.5	9.5
Motor Gasoline	11,000 bbl	0.1	0.3	0.6	0.1
LPG (Propane)	332,000 bbl	1.2	3.8	11.8	2.3
Residual Fuel (e.g., #6 Oil)	151,000 bbl	0.9	2.9	2.1	0.4
Wood	20,000 cords	0.4	1.3	0.6	0.1
Kerosene	42,000 bbl	0.2	0.6	0.6	0.1
Coal	1,000 tons	<0.05	—	<0.05	—
TOTAL	**N/A**	**31.2**	**100**	**522.6**	**100**

Industrial

Energy use classified as industrial is that used in and for facilities and equipment used to produce, process, or assemble goods, comprising the activities of manufacturing, agriculture, forestry, fisheries, mining, and construction. This sector includes non-utility power producers, and fossil fuels used as raw materials for manufactured products (e.g., plastics, fertilizers).

Industrial Energy Consumption, 1999

Fuel Type	Quantity	TBtu	%	$Million	%
Wood	N/A	27.8	34.8	18.6	4.9
Electricity	3,588 million kWh	19.7	24.6	231.4	61.6
Other Petroleum	2,591,000 bbl	13.9	17.4	52.3	13.9
Natural Gas	6 bcf	6.0	7.5	27.2	7.2
Residual Fuel	711,000 bbl	4.5	5.6	9.8	2.6
#2 and Diesel	472,000 bbl	2.7	3.4	11.6	3.1
Asphalt and Road Oil	288,000 bbl	1.9	2.4	8.2	2.2
Other[1]	N/A	1.8	2.2	0.0	0.0
Gasoline	151,000 bbl	0.8	1.0	7.7	2.0
LPG (Propane)	194,000 bbl	0.7	0.9	6.0	1.6
Kerosene	19,000 bbl	0.1	0.1	0.5	0.1
Lubricants	25,000 bbl	0.1	0.1	2.5	0.7
Coal	0	0	—	0	—
TOTAL	**N/A**	**80.0**	**100**	**375.8**	**100**

[1] Other is geothermal, wind, photovoltaics, and solar thermal energy. There is no cost for this fuel, hence the cost is shown as 0.

Residential

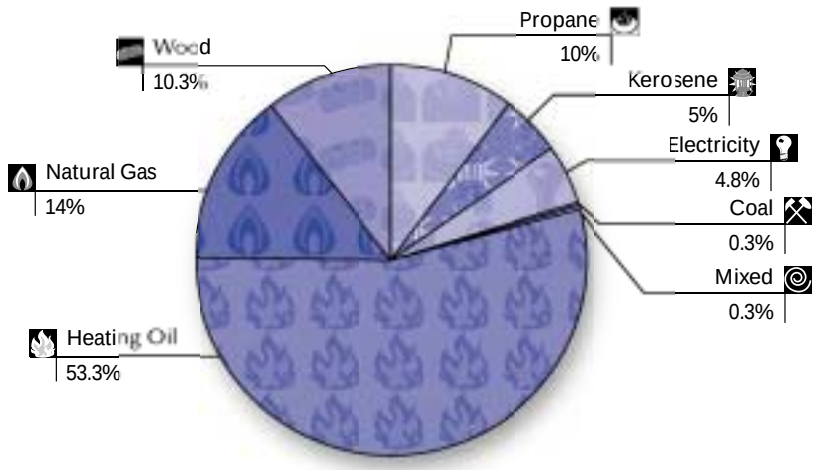
This sector includes only energy used in the living quarters of private households. The biggest use of energy in homes is space and water heating. Fuel choices for these uses are determined by numerous factors such as: type of system when house was built or purchased; convenience; fuel cost; environmental impacts of different types of heating systems; system efficiency; aesthetics.

Number of Households: 547,024 (2000 census)

Residential Energy Consumption, 1999

Fuel Type	Quantity	TBtu	%	$Million	%
Distillate (#2 heating oil)	4,555,000 bbl	26.5	46.2	147.3	18.4
Electricity	3,640 million kWh	12.4	21.6	496.5	62.2
LPG (Propane)	1,880,000 bbl	6.8	11.8	85.5	10.7
Natural Gas	7 bcf	6.7	11.6	50.7	6.4
Wood	143,000 cords	2.9	5.1	4.1	0.5
Kerosene	377,000 bbl	2.1	3.7	14.2	1.8
Coal	2,000 tons	<0.05	—	<0.05	—
TOTAL	**N/A**	**57.4**	**100**	**798.4**	**100**

Primary Heating Fuel Used, Residential, 1999-2000



Transportation

Transportation—the sector including all vehicles used to move people or goods from one place to another—accounts for just under 30% of New Hampshire's energy consumption, and 35.5% of New Hampshire's energy expenditures. Efforts like the New Hampshire Department of Transportation's RideShare and Park-and-Ride programs are underway in the state to affect the way we use our transportation infrastructure, in order to reduce individual use of vehicles and increase mass transit and alternatives to the automobile.

Transportation Energy Consumption 1999

Fuel Type	Quantity	TBtu	%	$Million	%
Diesel	2,496,000 bbl	14.5	14.4	123.1	13.2
Natural Gas	<0.05 bcf	<0.05	<0.05	—	—
Motor Gasoline	15,496,000 bbl	80.8	80.4	783.6	83.9
LPG (Propane)	<500 bbl	<0.05	<0.05	<0.05	—
Aviation Gasoline	28,000 bbl	0.1	1	2.0	—
Jet Fuel	820,000 bbl	4.6	6.0	19.8	2.1
Lubricants	64,000 bbl	0.4	0.4	6.5	0.7
Residual Fuel	1,000 bbl	<0.05	<0.05	<0.05	—
TOTAL	**N/A**	**100.5**	**100**	**934.2**	**100**

Changing Energy Consumption

New Hampshire generates most of its energy from fossil fuels. Data from the **New Hampshire Energy Consumption** chart on page 6 show that, of the 335.4 TBtus of energy used in New Hampshire, 243.9 TBtus, or 73 percent, comes from fossil fuels.

In New Hampshire, the greatest single use of fossil fuels is for transportation. Two programs at the Governor's Office of Energy and Community Services are aimed at reducing the amount of fossil fuels used in transportation: the Alternative Fuel Vehicle (AFV) program, and the Granite State Clean Cities Coalition, operating together as the **New Hampshire Alliance for Clean Transportation Systems (NHACTS)**.

The **AFV Project** includes the Governor's Office of Energy and Community Services (ECS), the NH Department of Transportation, the NH Department of Environmental Services, the University System of New Hampshire and other State agencies that today operate more than 75 alternative fuel vehicles in the State fleet, including vehicles that run on electricity and natural gas.

The Granite State Clean Cities Coalition (GSCCC) is a locally based, voluntary partnership of 40 public and private organizations working to purchase vehicles using natural gas, electricity, hydrogen, biodiesel, propane and other alternative fuels in the Granite State.

Recently the GSCCC helped the City of Keene and Keene State College in an ongoing program to use biodiesel fuel to replace or supplement diesel fuel in heavy equipment there. The move also helped the city and the college in achieving their pollution-reduction goals under the International Cities for Climate Change program.

ENERGY AND THE ENVIRONMENT

On a global scale, it is estimated that human energy use causes 80 percent of air pollution and generates 88 percent of greenhouse gases, with automobile exhaust being the best-known example. Understanding this relationship between the production and use of energy and pollution, New Hampshire has taken important steps toward reducing emissions of all kinds.

The State of New Hampshire has initiated a number of programs to help reduce pollution from State government. For example, the Governor's Office of Energy and Community Services' (ECS) Building Energy Conservation Initiative is reducing the emissions from State facilities by reducing the amount of energy the State uses. The first five projects, which renovated more than 1.1 million square feet of State buildings, have saved the State more than $700,000 in energy costs and reduced annual emissions by more than 2,600 tons of carbon dioxide (CO_2), 12.9 tons of sulfur dioxide (SO_2), and 4.3 tons of nitrogen oxides (NOx).

As noted on page 15, the transportation sector is the largest in terms of energy consumption in New Hampshire. Motor vehicles consume the most fossil fuel products and therefore contribute a significant proportion of the air pollution in our environment. The EPA estimates that 41 percent of toxic pollutants in air come from mobile sources.

Working to combat pollution from motor vehicles is NHACTS (The New Hampshire Alliance for Clean Transportation Systems) a joint effort of the Governor's Office of Energy and Community Services and the Department of Environmental Services to reduce pollution from transportation fuel use. The Alliance includes the Alternative Fuel Vehicle program of the State and the Granite State Clean Cities Coalition, which includes more than 40 partners working to make it possible for more New Hampshire vehicles to burn cleaner fuels like biodiesel, natural gas, propane, and, eventually, hydrogen.

Because the transportation and energy sectors are readily identifiable and quantifiable as sources of pollution (contributions of other sectors are mixed and much harder to define), specific information on pollution from these sectors is included here.

Motor Vehicles, Energy and Air Pollution, 1999

Registered motor vehicles, all types	1,226,945
Vehicle miles traveled per day	32.5 million
Total vehicle miles traveled	11,862,500,000
Gasoline consumed, gallons	657,680,000
Diesel fuel consumed, gallons	117,000,000
Energy consumed, TBtu	96
Carbon monoxide (CO) emitted/day, tons	613.6
Total CO emitted, tons	224,000
Nitrogen oxides (NOx) emitted/day, tons	98
Total NOx emitted, tons	35,770
Volatile organic compounds (VOC) emitted/day, tons	60
Total VOC emitted, tons	21,900

Currently, New Hampshire's electric distribution utilities are administering energy efficiency programs for their customers. When fully implemented, these programs, which include a spectrum of residential, commercial and industrial efforts, have the potential to reduce electric use in New Hampshire by more than 704.7 megaWatt hours, and keep 522.8 tons of CO_2, more than three tons of sulfur dioxide, and 1,830 pounds of nitrogen oxides from New Hampshire's air.

New Hampshire was the first state in the union to pass a four-pollutant law (the Clean Power Act) to reduce electric-plant stack emissions of mercury and three major air pollutants: sulfur dioxides (SO_2); nitrogen oxides (NOx); and carbon dioxide (CO_2). The act requires that electric generating plants meet levels for emissions or offset their emissions with the purchase of pollution credits from less-polluting plants upwind.

Pollutants Emitted by Utilities' Electric Generation, From All Energy Sources, 1999

Pollutant	Total Emission, Tons	Tons/ kWh (lb/kWh)
CO_2	5,578,224	0.34212 (.688)
NOx	12,077	0.0000007 (0.0015)
SOx	55,694	0.0000034 (0.00687)

Total Electric Power Industry Emissions Estimates by Energy Source, 1999, Nearest Thousand Tons

Energy Source	Sulfur Dioxide		Nitrogen Oxides		Carbon Dioxide	
	lb/kWh	Tons	lb/kWh	Tons	lb/kWh	Tons
Coal	0.0138-0.02349	34,000	0.0003-0.0004	8,000	2.04	3,388,000
Petroleum	"	14,000	0.0003-0.0004	1,000	1.64*	1,174,000
Natural Gas	trace	trace	not avail.	not avail.	1.095	41,000
Wood (mainly)	0.00011-0.00015	0	0.0003-0.0004	2,000	0.47**	179,000**

*Calculated from the carbon ratios for coal and petroleum and assuming same cycle efficiency for coal and oil fired boilers.
** Net is zero over sustainable growth/harvest cycle.

Glossary

Terms in **bold** within definitions are themselves defined elsewhere in the glossary.

Barrel (of oil) Equal to forty-two gallons; not to be confused with a 55-gallon drum; abbreviated bbl.

bcf billion cubic feet, commonly used for natural gas quantity.

Btu British thermal unit. Since all energy can be converted to other forms, such as chemical energy in gasoline to **heat** in the car's engine to mechanical energy of moving parts, it is possible and convenient to express various forms of energy in a single kind of energy "currency". The English system uses the Btu. It is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. Easier to remember: it is approximately the heat released by burning one kitchen match.

Tbtu—trillion Btus

Capacity (vs **Generation**) (**see also Generating Capability**) This is the difference between a kilowatt, for example, and a kilowatt-hour. A power plant may have a rated capacity of 500 megaWatts (500,000 kilowatts). However, that plant may operate at full capacity 95% of the time in one year and be shut down for maintenance or repair the remaining 5% of the time. If so, then its total generation will be 500 megaWatts x 365 days/year x 24 hours/day x 0.95 = 4,161,000 megaWatt-hours per year (for that particular year). This explains the apparent discrepancy between the NEPOOL generating capacity of about 27,600 megaWatts and its projected production of over 130,000,000 megaWatt-hours for 2002.

Carbon, Carbon Dioxide While not a pollutant by definition, carbon dioxide is of concern because it is a "greenhouse" gas. That is, it makes the atmosphere less transparent to heat and thus heat generated at or near Earth's surface cannot radiate into space as readily, so the heat can build up on the atmosphere and cause its temperature to increase. Many scientists believe that the well-documented increase in the atmosphere's carbon dioxide concentration is responsible for at least a significant portion of the observed global warming trend. Carbon dioxide is an unavoidable product of the burning of any fossil fuel or any biomass such as wood, though different fuels have different carbon contents, so that some fuels, such as natural gas, produce less carbon dioxide per Btu of heat when burned than do others, such as coal.

Distillate Any of a group of liquids separated from crude petroleum (a **fossil fuel**) by a process of heating, evaporating and cooling. Examples: heating oil, asphalt, kerosene, diesel fuel, jet fuel. Gasoline, while derived ultimately from crude petroleum, undergoes significant chemical modification, so is not considered a distillate, but a manufactured product.

Energy The ability do work. **Work** is moving a force over a distance. For example, throwing a ball is expending energy. Similarly, it requires the expenditure of energy to evaporate water from an ocean and to put that water into the atmosphere. In each example, work has been done.

Fossil fuels Fuels which are extracted (literally, from the Latin, fossere, to dig) from the ground. Examples are coal, crude petroleum ("oil"), and natural gas. They are the modified chemical remains of once-living organisms; thus the energy we obtain by burning them can be traced to the Sun. We extract fossil fuels at a far higher rate than they are being formed, so they are essentially non-renewable.

GSP Gross State Product. The total dollar value of all goods and services produced in the state. It is typically determined on an annual basis.

Generating Capability The demonstrated amount of electricity that a particular generating facility can produce at a given moment. Typically, the stated or claimed generating capability is the summer generating capability, as this represents how much electricity can be produced in the season of greatest demand and lowest capability. For heat-driven generators, the generating capability in summer is less than the generating **capacity** given on the generator's nameplate because of the smaller temperature difference between the heat source (such as a boiler) and the final "sink" for the heat, usually the air around the generator or a body of water. The amount of work—in this case the generation of electricity—that a heat engine can do is directly related to the temperature difference between the engine's heat source and the heat sink.

Heat The form of energy that all other forms eventually become. It is what causes **temperature**. If heat is concentrated, the material which contains it can be very hot. As heat flows out to a cooler environment, work can be extracted from the heat. This is exactly what happens to the heat energy in a furnace, a boiler, or in a car's engine.

KW Kilowatt. A unit of **power**, equal to one thousand **Watts**. Used in the US mainly to measure electric power production and consumption.

KWh (also kWh) **Kilowatt-hour**. The production (or consumption) of one **Watt** of power for a period of one hour. It is any combination of power production (or consumption) multiplied by a time interval such that the product is one kWh. Example: consumption of two Watts for one-half hour is equal to 1 kWh, or consumption of one-half watt for two hours is equal to 1 kWh. One kWh = 3413 Btu.

LFG Landfill gas, a product of organic waste decomposition in landfills. It consists typically of about equal amounts of methane and carbon dioxide, both of which are greenhouse gases. LFG can be collected and burned to extract energy for generation of electricity or for other uses. During combustion, the carbon in methane is converted to carbon dioxide, which, molecule for molecule, has a much weaker greenhouse effect than methane does.

MW megaWatt. Simply, one thousand **kilowatts**, therefore one million (prefix: mega) **Watts**. When a quantity is too large relative to the chosen unit size, a larger unit is often selected to reduce the size of the number that represents the quantity. Thus, NH generation capability is 2,851 MW, which is more convenient than stating that amount of power as 2,851,000 KW.

NOx Nitrogen oxides. A series of compounds of nitrogen and oxygen which are byproducts of many combustion processes. They are of concern here mainly because these oxides enter the air where they react with water to produce nitric acid, or with other substances in the air to produce irritating secondary pollutants such as ozone. NOx and **SOx** are the main causes of acid deposition (acid rain, snow, fog and dry deposition).

Power The rate at which energy is produced or used. Example: It is one thing to release the energy in a gallon of gasoline over a period half an hour while driving; quite another to release the same amount of energy in a fraction of a second by detonating a dozen sticks of dynamite. The amount of energy released is the same, but the dynamite explosion produces much more power.

Primary energy source An energy source that is not derived from a prior, earthly source. Examples: fossil fuels, wood, wind, hydro, and nuclear energy.

Secondary energy source An energy source that is derived from another energy source. Examples: electricity derived from burning of coal; steam from burning of natural gas.

SOx Sulfur oxides. Two different compounds of sulfur and oxygen, of concern because sulfur oxides react with water in the air to form sulfuric acid (See **NOx**.). SOx is produced by the combustion of materials containing sulfur. Various fossil fuels, especially coal and certain grades of fuel oil, are significant sources of sulfur oxides. The most important sulfur oxide is sulfur dioxide, SO_2.

VOC Volatile organic compounds. Carbon-containing chemicals that evaporate readily into the air; many are produced by plants, while many more result from evaporation of fuels such as gasoline. The majority of air toxics listed in the Clean Air Act are VOCs. In addition to being toxic in their own right, VOCs react in sunlight with NOx to produce a mixture of pollutants called photochemical smog, which includes irritants such as ozone and peroxyacetyl nitrate (PAN).

Watt A unit of **power**. Named for James Watt, who, in 1782, invented the first rotary-motion steam engine, capable of powering a variety of machinery—including, about 100 years later, electric generators. See also **KW** and **MW**.

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