Governor's Office of Energy and Community Services

EN-tech Newsletter

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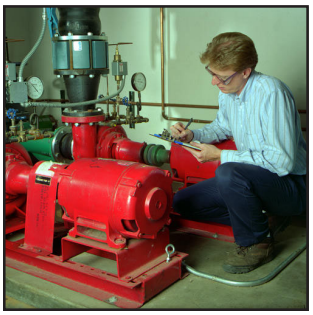
Bringing energy technology ideas to New Hampshire's businesses, cities, towns, and schools.

DOE supports assessments to find energy, resource cuts

New Hampshire businesses and industries that use large amounts of energy may be able to benefit from plant-wide energy assessments underwritten by grants from the U. S. Dept. of Energy.



Because energy use in forest products, chemicals, steel, aluminum, metal casting, and glass manufacturing can account for 10 percent or more of operating costs, DOE's Office of Industrial Technologies (OIT) recommends assessments as the best way to become more competitive through energy efficiency.

The Industrial Assessment Center at the University of Massachusetts is under contract with DOE to perform plant-wide assessments.

"We go to companies where we feel we can make a difference, but they need to have energy bills of $100,000 or more to be able to benefit," according to Beka Kosanovich, director of the UMass IAC.

"We like to have people come to us, because then we can be sure they are really interested in making some changes." They address technology areas important to entire industrial sectors as well as improvements specific to a given plant. Finally, they focus on individual process-optimization methods within the production process at the plant they visit.

"Typically we are looking at things like motors, heat recovery, process flows, fuel switching and more efficient equipment as the areas where industries can make the most energy-saving changes," Kosanovich says. "Our IAC has the largest number of different things we can recommend of all the centers nationally, and

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Vendors and participants enjoyed two geothermal workshops put on by Rebuild NH. For more on ground source heat pumps, see our GSHP Forum in the center section.

Granite State Clean Cities–

Alternative Fuels Plan to Kick Off at UNH May 31

New Hampshire Governor Jeanne Shaheen will preside at the designation ceremony for the Granite State Clean Cities Coalition's (GSCCC) statewide effort to reduce motor vehicle pollution and dependence on foreign oil by increasing use of cleaner burning alternative fuels.

U. S. Senator Bob Smith will also attend the ceremonies, scheduled for Friday, May 31 at the University of New Hampshire.

The ceremony is scheduled to begin at 10:00 a.m., when various alternative fuel vehicles will be on hand at the New England Center, where the formal ceremonies will begin at 10:45.

GSCCC is a locally-based, voluntary, public-private partnership created to encourage and expand the use of alternatives to gasoline and diesel fuel in transportation.

Clean Cities continued p. 5

Distributed energy may meet high-tech needs

The U. S. Department of Energy (DOE) recently announced awards of $9 million for research and development, and testing of distributed energy resources (DER). The results will be of interest to New Hampshire's data processing and telecommunications industries.

DER applications, which would provide locally generated power, ideally using clean, renewable source fuels, and take advantage of new technologies like CHP (combined heat and power) and storage capacities, may be a source for reliable, efficient, potentially uninterruptible power.

An award of $3 million went to Durst Development of New York to design a highly efficient, low-emitting, highly reliable gas turbine generator, coupled with a chiller, producing cold water for air conditioning. Steam generated from turbine exhaust heat will drive the chiller. The system, which will serve as a model for future facilities, will supply a new data center in Manhattan.

With a grant of $150,000, EPRI-PEAC of Knoxville, TN, will

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NH Energy Facts –

Energy Office offers factsheet

The Governor's Office of Energy and Community Services has compiled data on energy supply and demand in New Hampshire through 1999. It is now available to the public in the New Hampshire Energy Fact Sheet, a one-page compendium of detailed information about how much energy is produced and used in New Hampshire, what types of fuels make that possible, and how much it costs.

For instance, you may not have known that, through 1999:

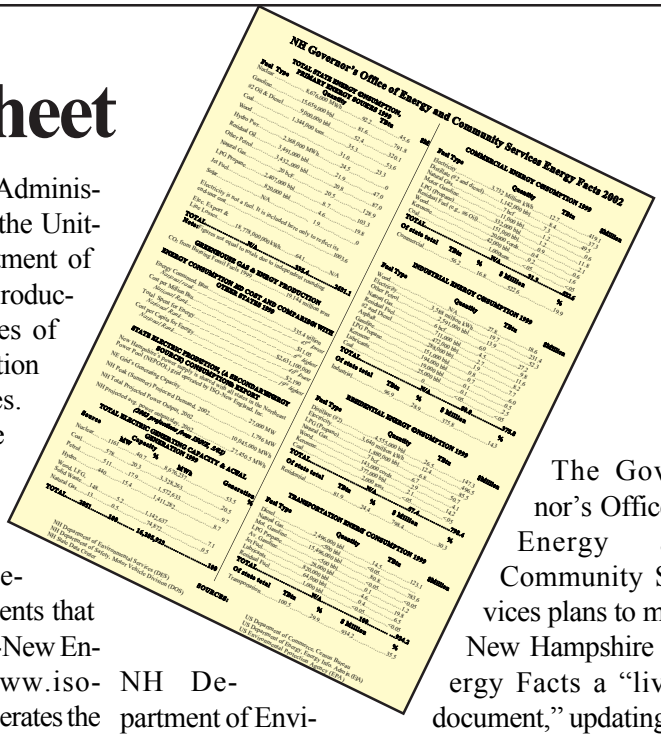
- more than 29 percent of the electricity generated in New Hampshire wasn't used here;
- our state was the 45th lowest consumer of energy in the United States, but the 19th highest in cost per capita for that energy;
- commercial and industrial use of energy in the state cost about $900 million annually, but that transportation energy use topped that by another $34 million;
- residential energy use in the state cost $798 million; or
- hydropower provided 9 percent of the electricity generated in New Hampshire.

Or that the number one source of Btus used in industry in New Hampshire (35%) was not electricity, fuel oil or coal, but wood.

To get a copy of the Fact Sheet, visit the website of the Governor's Office of Energy and Community Services at www.nhecs.org, and look for the New Hampshire Energy Facts link. There you'll find both a Word file and an Adobe Acrobat.pdf file you can download or view on screen.

If you'd like hard copy, call us at 271-2611 and we'll send you one.

New Hampshire Energy Facts are gleaned (by Energy Program Manager Joe Broyles) from a number of sources. The Energy Information Administration (EIA) of the United States Department of Energy (DOE) produces annual updates of energy consumption and expenditures. In addition, the EIA web site, www.eia.doe.gov, has numerous reports and documents that are sources. ISO-New England, Inc., www.iso-ne.com, which operates the electric grid in New England, provided information on electric capacity, generation and demand.


NH Governor's Office of Energy and Community Services Energy Facts 2002

NH Department of Environmental Services (DES), www.des.state.nh.us, is the source of CO_2 emissions information.

The Governor's Office of Energy and Community Services plans to make New Hampshire Energy Facts a "living document," updating information as new data becomes available from these and other sources.

N.H. Commercial and Industrial Energy Code Trainings Set

According to a study funded by the Governor's Office of Energy and Community Services, PSNH, and Granite State Electric, there is confusion surrounding the Commercial and Industrial Energy Codes (ASHRAE 90.1 – 1989) among builders, design professionals, code officials, and engineers.

Results of the survey indicated building professionals felt a lack of knowledge of the existing code was a major reason for compliance shortfalls.

ECS, PSNH, and Granite State Electric are co-sponsoring a series of trainings on the C&I Energy Code that will be tailored to engineers, designers, and code officials. Each professional area will have its own set of half-day codes trainings to attend around the state.Trainings are scheduled for the following discipline areas:

- June 13, Hanover: Architectural and Mechanical
- June 20, Manchester: Architectural and Lighting
- June 26, Plymouth: Lighting and Buildings
- July 11, Durham: Architectural and Mechanical
- July 18, Keene: Architectural and Lighting
- July 24, Concord: Mechanical and Lighting
- July 30, Manchester: Mechanical and Building
- August 6, Durham: Mechanical and Lighting
- August 8, Manchester: Architectural and Building

For more information, or for updates on the schedule, visit www.nhecs.org, or call Derek Greenauer at 603-271-0477

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we are proud of that."

Of particular interest to DOE's OIT are best practices and new technologies in steam delivery (see article, page X) and process heating systems, electric motors (including drives, pumps, and blowers), compressed air systems and heat exchangers.

Assessments also look at supply-side options such as co-generation and combined heat and power systems.

"Our average savings are about $35,000 a year, but our average recommendations would save about $100,000 a year," Kosanovich notes.

"Most companies do about half of what we recommend, and work their way up to what they can afford to do."

Results, successes, and experiences from assessments are published—confidentially and with full proprietary protection—in case studies and Energy Matters newsletter.

To find out if your company is eligible for an OIT grant, visit the OIT website at www.oit.doe.gov/bestpractices/plant_wide_assessments.shtml and download the Energy Assessments fact sheet .pdf file, or call the UMass IAC at 413-545-0684.

Ground Source Heat Pump Forum

As a result of a controversy over accurate numbers arising out of a story in our last--and first--issue,* EN-tech *asked a number of authorities on ground-source heat-pump technology to gives us their views on the efficacy of using GSHP in New Hampshire. Herewith, four perspectives on GSHP potential and performance.

Four questions to ask–

When do ground source heat pumps make sense?

by Marc Rosenbaum,
P.E., Energysmiths, Meriden, NH

My work is helping people create environmentally friendly projects, from single-family homes to cohousing neighborhoods to commercial and institutional projects of major scale. Every project has unique features and constraints that generate the strategies I choose to recommend to the owner and architect/engineer team. I tend to consider Ground Source Heat Pumps (GSHPs) when any of the following may be present:

1 - The building has a large cooling load even after all sensible load avoidance techniques have been implemented. This is not the norm in N.H. For instance, most public schools are not cooled.

2 - There is no appropriate location on the site for above ground cooling load rejection. On a recent institutional project, GSHPs were recommended due to site constraints for cooling rejection, even though the heating load of the building would be served by a passing steam line.

3 - There is a desire on the part of the owner to have a zero-net energy project, in which all the energy used is generated by renewable sources. I am currently working on a home that will have a grid-tied 10 kW wind turbine. Using GSHPs allows the most efficient and direct use of the electricity generated by the turbine. Designing the distribution system to use the lowest possible water temperature for heating keeps efficiency of the GSHP high.

4 - There is a desire on the part of the owner to completely avoid fossil fuels on the property, due to health and safety concerns. GSHPs can be a good strategy for the environmentally ill.

No one technology is a magic bullet. In general, I have found that, with New Hampshire's primarily heating climate and very high electric rates, GSHPs aren't the best financial investment. But this depends on costs of fossil or biomass fuels and systems, costs of the actual GSHP installation, method of connecting to the ground, costs of electricity, and available subsidies.

A Calculator–

What can you save – and spend?

by Carl Orio

The owners of the 3,156 square foot geothermal heat pump home in Bow NH, pictured here, paid only $570 last year for heat, hot water, and air conditioning. That works out to $0.18/sqft/year.

In a study by Public Service of New Hampshire (PSNH), 23 "Energy Crafted" homes–which exceed state building codes for insulation, sealing, and method of heating and cooling–using geothermal heat pumps, were monitored for more than a year. The average energy use per square-foot for heat, hot water, and air conditioning in these homes was 3.7 kWh. At PSNH's current average kWh rate of 12 cents, that would be 44 cents per square foot per year.

A total of forty-three homes are now under this program and are being monitored. The range of electrical energy used is from 2.2 to 5.9 kWh/sqft/year.

Meanwhile, in a similar test of conventionally built homes using geothermal in central Maine, the average energy use was 4.9 kWh.

W x R x SF = average annual cost, a reasonable estimate of annual costs if you were a heat pump owner.

Knowing the type of construction of your home (conventional or energy-efficient) and the average electric rate in your area, you can make an estimate of annual heating, cooling and domestic hot water costs. Multiply the average kiloWatt hours per square foot for your home type and area (W) by the average electric rate (R) and by the conditioned square feet (SF) in your house. From that calculation: W x R x SF = average annual cost, you can make a reasonable estimate of averaged annual costs for a potential heat pump customer – keep in mind there is quite a spread on these factors and the results of that simple multiplication will be a fair *average.*

So, if you live in a conventional home (4.9 kilo Watt hours per square foot) of 2,000 square feet and buy your power from PSNH ($0.12 per kWh), your equation looks like this 4.9 x 2000 x .12= $1,176 per year for energy—if you have a geothermal system. Subtract that from your current energy costs, and you'll know how much you have, in savings, to spend on a GSHP system.

Carl Orio is president of Water and Energy Systems, Inc. in Atkinson, NH.

Federal investment in GSHPs testament to energy efficiency

Federal facilities bought into geothermal heat pumps (GHPs) in a big way in 2001, bringing the total federal investment in GHPs to about $200 million, and an estimated 40,000 tons of GHP capacity now installed in the federal sector, which equates to at least 15,000 individual GHPs in U.S. federal buildings.

In late 1998, in response to the interest of federal agencies in GHPs, FEMP initiated a program offering technical and financing assistance specifically geared to the application of GHP technology. Since then the annual federal investment in GHPs has grown from $6 million in 1999, to $13 million in 2000, to $74 million in 2001, which includes about $47 million under Super Energy Savings Performance Contracts (Super ESPCs), $24 million under utility energy services contracts (UESCs), and $4 million funded by appropriations. The trend is going strong, with another $70 million worth of federal GHP projects already under development.

FEMP's GHP program was established to make the energy- and cost-saving benefits of GHPs easily accessible to all federal agencies by overcoming technical obstacles and providing a vehicle for financing federal GHP projects. FEMP's long-term goal was to help bring GHPs into the mainstream to lower their cost and to fully realize their potential to save energy and help meet energy goals in the federal sector.

Douglas Sattler of Alliant Integrated Services (formerly Energy Performance Services, Inc.), one of the energy service companies (ESCOs), points to Oak Ridge's critical role in GHP research: "Though the technology has been available since the 1950s, GHPs were considered by many agencies to be new and unproven before ORNL's evaluation of the 1996-97 Fort Polk GHP project," where GHPs and other energy conservation measures were installed in 4003 family housing units under a site-specific contract.

"That evaluation revealed that GHPs are based on a sound, economically viable, energy-efficient, renewable technology."

The burst of investment in 2001, and the range of projects it includes, signifies the breakthrough of GHP technology into the mainstream. In September 2001, the Army's Fort Jackson in South Carolina awarded a $19 million delivery order that includes $10 million for GHP retrofits, demonstrating that the industry infrastructure to support GHP technology is growing, FEMP's GHP strategy is paying off, and GHP's reputation as a proven, efficient, and cost-effective technology is established.

FEMP's efforts to give agencies easy access to the prodigious benefits of GHPs have depended heavily on its partners in the energy industry — ESCOs, utility companies, and subcontractors who design and install GHP systems. An attribute seen in every successful GHP project is a healthy working relationship between customers and service provider.

FEMP's utility partners haven't hesitated to help their customers acquire GHPs, and one of the largest federal projects ever financed was for GHP retrofits. U.S. Marine Corps Base Camp Lejeune last summer finished retrofitting 2089 family housing units with GHPs under a $15 million contract with Carolina Power & Light.

This article mentions just a few milestones in the emergence of GHPs into the mainstream, but there are many notable projects to learn from. Federal facilities are now using GHPs in all kinds of buildings, benefiting from energy and cost savings, improved comfort, and minimal maintenance costs.

For information about GHP technology, visit the GHP pages on FEMP's web site at http://www.eren.doe.gov/femp/financing/espc/geothermal_heat_pumps.html.

GSP vs. conventional–

What real numbers can you expect?

by John Shonder
Leader,
Federal Energy Management Program (FEMP)
GHP Core Team

Of course, the savings from a given application depends on location, occupancy patterns, building construction, and the type of equipment geothermal is measured against, but a realistic range for savings in commercial buildings would be 15-25% of total building energy use. For residential buildings, savings can be as high as 40 %.

As an example of commercial savings, we developed a detailed simulation model for an elementary school in Lincoln, Nebraska, that uses geothermal heat pumps. The model was calibrated to a year's worth of data collected at the site, so we are confident of its performance.

Using this model we were able to estimate the school's energy consumption had it been using a conventional four-pipe boiler/chiller system. The numbers below give energy end-uses on an annual basis:

There are different methods of calculating energy savings in systems that consume both electricity and natural gas, but the most logical is to consider source energy use. Assuming 33% conversion efficiency for electricity, the GHPs save about 19% over the boiler/chiller system. For a school in Boulder Colorado, we saw similar results, with about a 15% annual savings on a source energy basis.

Annualized energy use comparison, Lincoln, Nebraska, school

Use	*GHP*	*Boiler/chiller*
Non-HVAC electric	255,807 kWh	255,807 kWh
HVAC electric	288,197 kWh	306,855 kWh
HVAC gas	7,535 therms	22,648 therms
DHW gas	5,547 therms	5,547 therms

Input from energy users critical to NH Energy Plan

Energy planning for the State of New Hampshire is underway.

As a result of the passage last year of HB443, New Hampshire is taking an important step toward ensuring a safe, reliable, and environmentally sound energy future for our state. The bill charges the Governor's Office of Energy and Community Services (ECS) with developing a 10-year comprehensive New Hampshire Energy Plan (NHEP).

Governor Shaheen and ECS believe that this is an important opportunity to provide information on New Hampshire's current energy landscape and to plan for the State's future energy goals.

Public hearings, where private citizens, local government, and business and industry will be invited to participate, are being held throughout the state. The first hearing, April 3, was held in Manchester; the second, in Portsmouth, was May 2. The third hearing is scheduled for May 9, at 7 p.m. in the Keene Public Library. Belmont will be the site of a hearing at 7 p.m. on May 21, and Berlin on June 3, while other hearings are being scheduled for Lebanon, and other North Country sites.

A public hearing is scheduled for 7 p.m. May 21 in Belmont, and at 7 p.m., June 3 in Berlin.

With strong support from stakeholders including businesses, nonprofits, utilities, and environmental organizations, the bill calls for an energy plan that focuses on both the supply and demand for energy resources, transmission and distribution infrastructure, fuel diversity, energy efficiency and conservation initiatives, regional issues, and provides policy recommendations for the State's energy future.

The planning and assessment process will include analyzing demand projections, the adequacy of generation and transmission systems, siting requirements, fuel sources, and how New Hampshire can continue to play a strong role at the regionally and nationally.

In order to create a comprehensive plan, ECS is working with a group of consultants who are experts in the field of energy planning, including Policy Assessment Corporation and Systematic Solutions, and Sylvatica, Inc.

For more information on hearing times, dates, and locations, or about upcoming stakeholder meetings, visit the ECS web site at nhecs.org and click on the NHEP logo.

GSCCC will work to increase the number of alternative fuel vehicles–like the ECS electric car plugged in above–in NH from 206 to 439 by 2006.

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The group received approval in January for their plan from the U. S. Department of Energy, joining more than 80 other coalitions nationwide in the federal Clean Cities Program.

The fundamental purpose of GSCCC is to create a favorable, market-driven environment for alternative fuel–including electricity, propane, natural gas, biodiesel, and hydrogen–reducing dependence on gasoline and decreasing a variety of pollutants responsible for air, groundwater and public health problems, including asthma, heart disease, and cancer.

"Creating a steady growth of alternative fuel vehicle and refueling stations will displace the use of more polluting conventional fuel in the Granite State," said Jack Ruderman, energy policy director at the Governor's Office of Energy and Community Services (ECS), which, along with the state Department of Environmental Services (DES), has taken a lead in moving the plan and the Granite State coalition forward.

Rebecca Ohler, an air quality engineer with DES who played a key role in getting the New Hampshire plan approved by DOE, said the coalition's goal of expansion of the refueling infrastructure for alternative fuels is crucial to increasing consumer use of alternative fuel vehicles.

The coalition also includes the University of New Hampshire, the Department of Transportation, and more than 30 other stakeholders, including environmental groups, government agencies, small businesses, energy providers, and transportation companies, as well as six cities and towns.

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develop a means for accurate comparison of DER applications with traditional alternatives in terms of the quality, reliability and availability of power. Their research will look at options for avoiding interruptions and voltage sags.

The Honeywell Corporation received $1.1 million to develop a DER system to allow the University of Miami Medical Center's data center to operate independent of the utility grid. Their system, employing multiple microturbines, will allow evaluation of how multiple generating units need to work together for maximum efficiency and reliability.

Sure Power of Danbury, CT will use $2.2 million to develop a DER/CHP system at Exodus Internet's data center near Seattle. Their research will identify end-use requirements peculiar to the high-tech industry.

Verizon, Inc., was awarded $3 million to help in construction and research for a multiple-DER unit facility that will allow direct DC-to-DC powering of telecommunication equipment to lower costs and increase reliability and efficiency by eliminating conversion to AC power.

Industry will contribute at least 50 percent of the total contract value of the projects, which will last up to three years.

Information is the key to energy management

by Hamilton McLean, Energy Manager, State of New Hampshire

Most homeowners or building managers can probably tell you how much they spend on energy, but not many know how or why the consumption rate is what it is for their home or building.

As the State Energy Manager, my job is to reduce the $18 million the State spends annually on energy. There are a number of initiatives underway to accomplish a least-cost energy future for the State of New Hampshire.

In order to make the best investment decisions, we must have information about how and where our facilities use energy. To this end, I am developing an energy accounting system, in partnership with various state agencies, to monitor, track, and verify our energy use and costs. This will allow all departments in state government to verify charges and enable us to understand how and where we use energy. This will also help target facilities that are big consumers of energy and would benefit the most from upgrades.

We are helping the Bureau of Public Works design and budget for buildings based on the cost of operation over the long term. Using a mechanism called "life-cycle costing," we determine which construction or reconstruction components are the most cost effective investment over the usable life of a building.

State buildings are intended to be in service for a long time. It makes good business sense to design and construct buildings in a way that ensures the lowest reasonable life-time operating costs, even if first costs are higher.

Here are some facts that offer insight into the scope of the State of New Hampshire's energy management effort:

- The State owns and operates more than 700 facilities totaling some 13 million square feet.
- Our facilities use natural gas, electric, steam, propane, kerosene and fuel oils as energy sources;
- The state does business with 237 different energy suppliers; each uses a unique system of identifying account numbers for each facility.

Information about energy use is clearly the key, then, to effective management of consumption and cost.

Hamilton McLean can be reached at hmclean@gov.state.nh.us.

What you need to know and what you gain

If you want to save energy and manage your future use and cost, you have to know:

- **How many units of energy** do your facilities use, and where and how is it used?
- **What is the remaining useful life** of your buildings and energy systems?
- **Can you get a usage profile** from your energy supplier?
- **What are your fuel costs** and what control do you have over them?
- **How many square feet** do you have?
- **Do you know all your account numbers** for all locations and energy sources?

By having this kind of information in hand, you will be able to:

- **Budget more accurately**
- **Shop for better energy prices**
- **Prioritize for energy improvements**
- **Troubleshoot problems and billing errors**
- **Know the value of energy use in order to create incentives**
- **Calculate payback for expenditures on upgrades**
- **Evaluate reduction programs**
- **Save money**

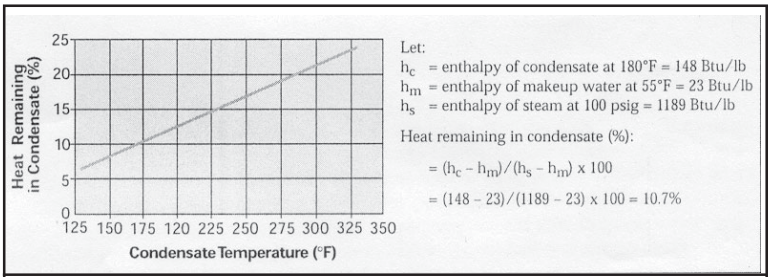
The key to energy management is information.The foundation for sound energy management in the future is time well spent getting your numbers in order.

Getting the most out of steam

Every year, industries using steam lose tens of thousands of dollars in unnecessary fuel costs because of inadequately designed steam systems.

If you use process steam in your facility—and a surprising number of manufacturers do—you need to look at the potential energy savings in condensate return, according to energy tips from the Office of Industrial Technology (OIT) at the U. S. Department of Energy (DOE).

When you take the energy out of steam in the manufacturing process, heat exchanger or coil, the steam reverts to water (condensate). This water is still somewhere between 130 degrees and 225 degrees F., however, containing enough energy to make returning it to the boiler worthwhile. The graph below indicates the amount of heat energy remaining in the water at various temperatures.



Condensate Heat Loss

Not only does returning water reduce the energy required to heat make-up water, it reduces your water bills and your sewage bill and treatment costs. This can be a significant savings: A large paper mill improved its condensate return from 65% to 86% of steam production, for instance, and saved $300,000 annually, easily covering the cost of improving the condensate return system.

It may be worth calculating your savings in water, sewer, and treatment chemicals and your fuel cost savings because, when you add the two savings together, you may find you can afford to upgrade or install a condensate return system.

You can find formulas for making these calculations, and more information about steam system maintainence, at the DOE OIT website, from which these facts and table were taken: www.oit. doe.gov/bestpractices/steam/.