A plate and frame heat exchanger, like the one shown above, is a common-sense investment for operators who want to control energy costs.

Power Moves

—Building/Retrofitting Plants for Improved Energy Efficiency

Today's operators can choose from an array of options that can save you money!

By Gerard O'Neill

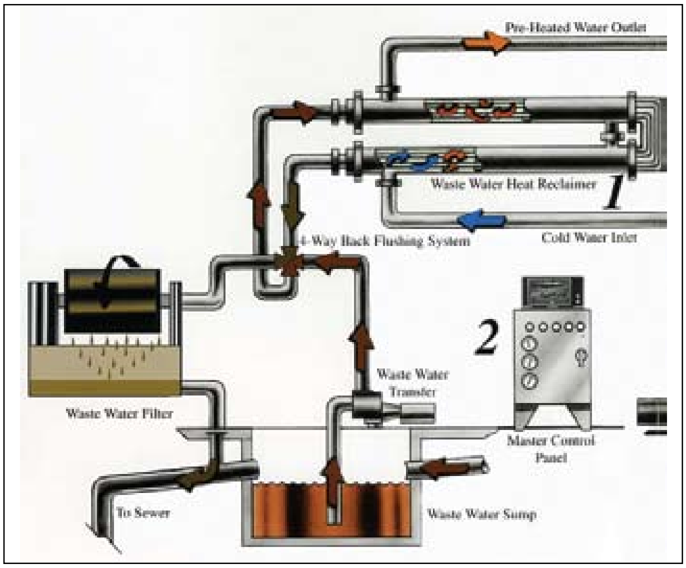
How many of you are getting a little tired of hearing "save energy" or "we need to be green" over and over again? As consultants we "preach" this time and time again on our projects. I must admit that I'm getting a little tired of hearing about it myself. The constant barrage from the so-called industry experts regarding dryer efficiency, water reuse, water recycling, alternate energy sources, wind farms and so on. For crying out loud, stop the madness! Where can I put a wind farm in a laundry anyway? Got any ideas? I sure would like to hear them!

How about a common-sense approach to some standard, tried and true ideas on energy efficiencies in OUR INDUSTRY? Ones that *REALLY* work!

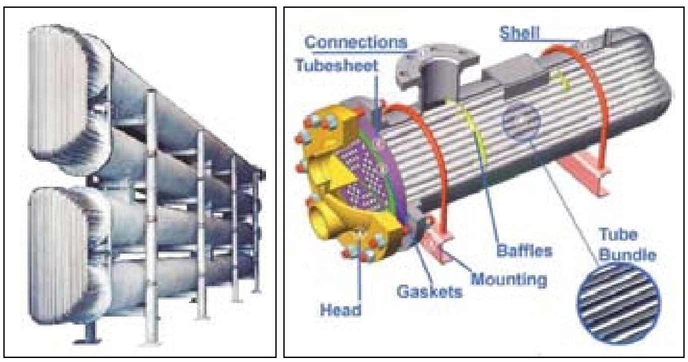
We at American Laundry Systems (ALS) are currently designing our *50th new plant* and hope to start installing equipment by mid-2009. Over the years, we've come across all kinds of crazy, harebrained ideas as well as some not so harebrained. We'd now like to take this opportunity to share with you, the operator, some of the latest ideas that we're currently—or contemplating—incorporating into our designs.

Let's start with some of the basic (MUST DO) ideas

Wastewater heat recovery:
Wastewater heat recovery systems capture the heat from the process wastewater to pre-heat incoming fresh water. For example, if the temperature of incoming fresh water is as low as 60º F, a heat recovery system (shell & tube or plate & frame) can effectively preheat



A schematic view of a wastewater heat recovery system

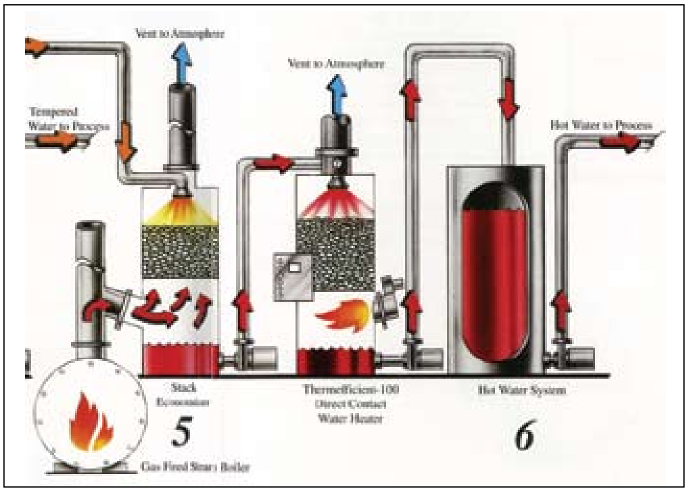


Two views of a tube and shell heat exchanger, including a cutaway image

that water to within 5º-10º F of the dirty wastewater stream, thus recovering up to 50%-60% of the water-heating energy required.

Expect a 12-to-24 month return on your investment with a Heat Reclaimer.

Boiler stack economizer:
During the boiler operation, water for the hot water process enters the top inlet of the economizer and is sprayed over the heat transfer



A schematic view of a boiler stack economizer system

media. Simultaneously, boiler flue gas is directed to the flue gas inlet at the base of the economizer. The water travels from the spray nozzle counter flow; from the rising flue gas through the stainless steel transfer media. As the water droplets travel through the media, the hot flue gas rises to the top of the economizer, preheating the water.

Flash steam recovery:
A flash steam recovery system is a conventional means for preheating and heating water. Each pound of condensate gives up approximately 144 Btu in the form of steam before it becomes water at 212° F. This surplus of 144 Btu flashes to vapor and escapes from the vent of the condensate receiver. This represents a loss of approximately 12% of a plant's fuel consumption.

Ceramic micro filtration & ceramic ultra filtration:
In a CMF/CUF contaminated wastewater is fed through ceramic


Three views of ceramic micro filtration systems

filter channels at a high velocity. The ceramic filters are coated with fine porosity membranes, which reject solids in the submicron size range. Clear filtered water permeates through the membrane and is discharged for recycling or discharge. Rejected contaminants flow from the filter channels and are collected and discharged in a concentrate waste stream.

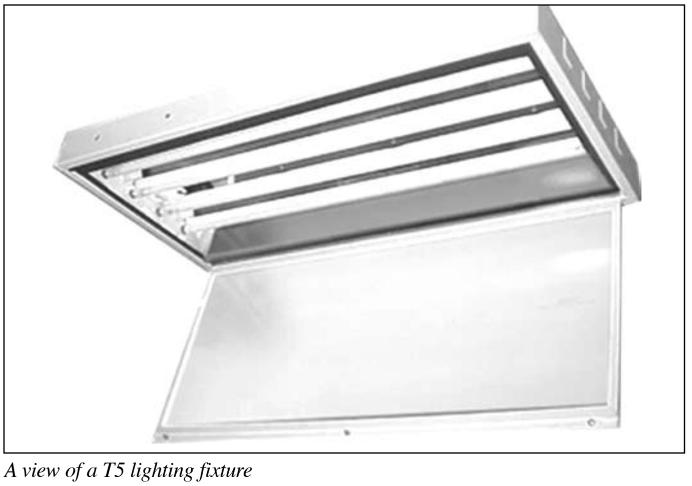
You can reduce water and discharge (sewer) costs and surcharges. Up to 90% wastewater recycling also is possible (under the right circumstances).

Coaxial Duct:
A coaxial duct is designed to carry hot moisture-laden exhaust gasses out of the plant through a properly sized center exhaust duct. The

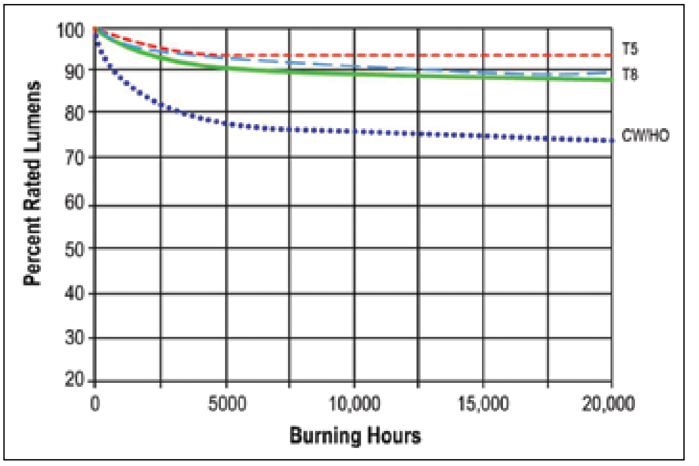
A view of dryers equipped with coaxial ducts

incoming outside "make up" air is carried in a fully enclosed, surrounding outer duct directly to the dryer air inlet. Using this method, you can achieve 5%-10% increases in efficiency.

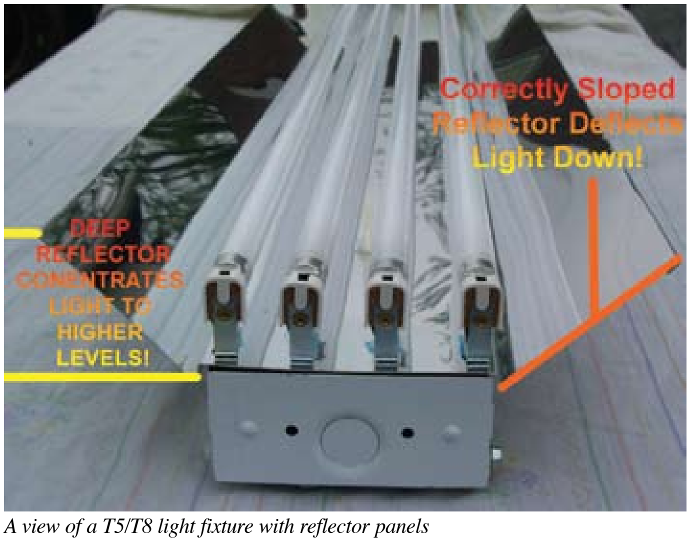
T5/T8 lighting:
T5HO & T8 Fluorescent High Bay Fixtures are specifically



A view of a T5 lighting fixture



The chart above documents the enhanced lighting capabilities of T5/T8 systems vs. CW/HO systems.



A view of a T5/T8 light fixture with reflector panels

designed to replace conventional H.I.D. lighting in commercial/industrial applications. A four-light 54-watt HO T5 high bay requires only 239 watts as compared to the metal halide, which consumes 454 watts. Furthermore, they feature lower lumen depreciation rates, better dimming options, virtually instant start-up and re-strike, and better color rendition. (Very important in a finishing department!)

Ozone Washing: What is ozone?
Ozone gas is composed of three oxygen atoms. It can be produced when energy (an electrical charge) breaks a stable molecule (O2) into two oxygen unstable atoms (O1). These two oxygen atoms alone seek stable O2 molecules and combine to

A view of an ozone generator system

become Ozone (O3). Ozone operates according to the principle of oxidation. When the static loaded ozone molecule (O_3) makes contact with something oxidizable, the charge of the ozone molecule will directly flow over. This is because ozone is very unstable and likes to revert to its original form (O_2). Ozone can oxidize with all kinds of materials, but also odor and microorganisms like viruses, moulds and bacteria. The extra oxygen atom releases from the ozone molecule and binds with the other material/soils.

Pipe insulation: insulation of steam lines
Thermal insulation provides important safety, energy savings and performance benefits. In terms of safety, insulation reduces the outer surface temperature of steam piping, which lessens the risk of burns.

Heat Loss per 100feet of Uninsulated Steam Pipe (MMBtu/hr)				
Distribution line diameter (inches)	Steam Pressure (psig)			
	15	150	300	600
1	0.016	0.033	0.043	0.010
2	0.027	0.055	0.072	0.096
4	0.047	0.097	0.128	0.171
8	0.085	0.176	0.232	0.311
12	0.120	0.251	0.332	0.448

The chart above documents heat loss per hundred feet of uninsulated pipe of various sizes.

A well-insulated system also reduces heat loss to ambient workspaces, which can make the work environment more comfortable. In addition to its safety and energy benefits, insulation increases the amount of steam energy available for end uses by decreasing the amount of heat lost from the distribution system. Insulation can typically reduce energy losses by 90% and help ensure proper steam pressure in plant equipment. Any surface over 120° F should be insulated, including boiler surfaces; steam and condensate return piping, and fittings.

Steam traps: leakage
Because of the many industrial uses for steam, there are wide ranges of steam-system sizes, configurations, end-use applications and operating practices. As a result, there are many different ways to improve steam system performance and to identify improvement opportunities. In general, performance is most effectively optimized when a systems approach is used. Often, operators are so focused on the immediate demands of the equipment that they overlook the broader issue of how system parameters affect overall efficiency.

Leaking Steam Trap Discharge Rate - Steam Loss (lbs/hr)				
Trap Orifice Diameter (inches)	Steam Pressure (psig)			
	15	100	150	300
1/32	0.85	3.3	4.8	-
1/6	3.4	13.2	18.9	36.2
1/8	13.7	52.8	75.8	145
3/16	30.7	119	170	326
1/4	54.7	211	303	579
3/8	123.0	475	682	1303

The chart above documents steam loss from leaking steam traps based on pressure and orifice size.

In steam systems that haven't been maintained for 3-5 years, about 15%-30% of the installed steam traps may have failed, thus allowing live steam to escape into the condensate return system. In systems with a regularly scheduled maintenance program, leaking traps should account for less than 5% of the trap population. If your steam distribution system includes more than 50 traps, a steam trap survey will probably reveal significant steam losses.

The table shown below/left gives leaking steam trap discharge rates for different trap orifice diameters under different pressure conditions (Boiler Efficiency Institute).

Wastewater for cooling and or heating plant/building:
Once we have taken all the latent heat (Btu) we need from the typical wastewater stream (via a wastewater heat exchanger) we should be left with 70°-80° F wastewater. In the proper application, this temperature water can be pumped from the pit and used "yet again" to heat the building/plant in the winter and cool the facility in the summer. (We all know of facilities that approach 90°-100° F (plus) in the summer, while they are much colder in the winter). The secondary system (make sure you use it FIRST for the "Laundry Process") can be pumped to a heat exchanger to "heat up" city water for heating the building, or through cool down heat exchangers to "cool down" the air in the facility. This needs to be incorporated in the HVAC system for the building itself!

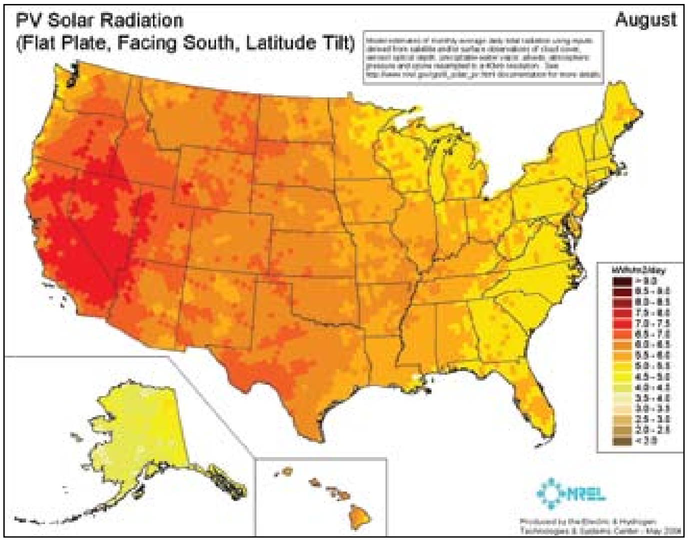
Optional (outside the box) ideas

Evaluating your site for a geothermal heat pump
Because shallow ground temperatures are relatively constant throughout the United States, geothermal heat pumps (GHPs) can be effectively used almost anywhere.

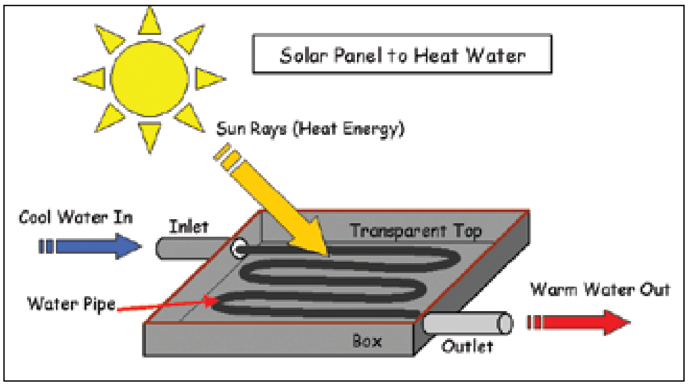
The chart above confirms that much of the Western United States has access to direct use of geothermal power. Geothermal heat pumps can be used nationwide, due to relatively constant shallow ground temperatures.

However, the specific geological, hydrological and spatial characteristics of your land will help your local system supplier/installer determine the best type of ground loop for your site: This can be a very expensive installation cost with up to 10 years for payback!

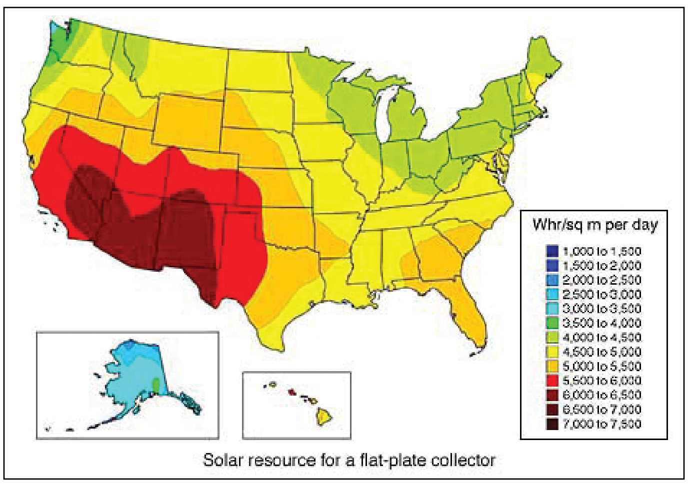
Solar energy (heating & cooling)
Sunny summer days are beautiful, yet in the office a hot day can be altogether stressful. Because productivity can suffer under such conditions, more and more buildings are being fitted with air-conditioning systems. This is where solar air conditioning comes in: The summer sun, which heats up offices, also delivers the energy to cool them. The thermal use of solar energy offers itself: Days that



The map above shows average daily total solar radiation based on satellite observations, allowing for factors such as cloud cover, water vapor and ozone.



The illustration above shows how operators can tap the sun's rays to heat water.



This chart tracks the potential for solar energy use by region.

have the greatest need for cooling are also the very same days that offer the maximum possible solar energy gain.

A view of a solar panel that's used to gather the sun's energy for industrial uses, such as heating buildings.

Solar space heating:
Even in the middle of winter, the sun provides incredible energy—enough to heat your entire building. With today's high costs of heating oil, gas and electricity, solar heating will rapidly pay for itself, over and over again.

Concentrated solar parabolic trough collectors:
Need extreme temperatures to run a steam turbine generator or power a high-temp industrial process up to 200°-750° F? Concentrated solar parabolic trough collector configurations up to 64 megawatts are available and are in use today in commercial utility power plants.

Steamless or 'steam-less' laundries:
To build a steamless, or better yet a 'steam–less' laundry, is an idea that's getting serious consideration in regard to energy reduction. There's a growing trend in Europe to build new laundries without a conventional steam boiler. Steam is mainly used for flatwork ironing, and process water heating inside batch washers. A typical steam laundry in Europe will utilize steam pressure of 12-13 bar steam (175-190 psi), so the costs for process steam are quite high.

Above, a thermal oil heating system for a tunnel washer and (at right) a water reuse system for a tunnel.

The steam-less laundry uses self-contained gas fired thermal fluid ironers to replace steam-heating conventional ironers. A hot water heater is used to heat water for washing. Process water heat exchangers are used to reheat reuse water. These process water heat exchangers come in several forms:

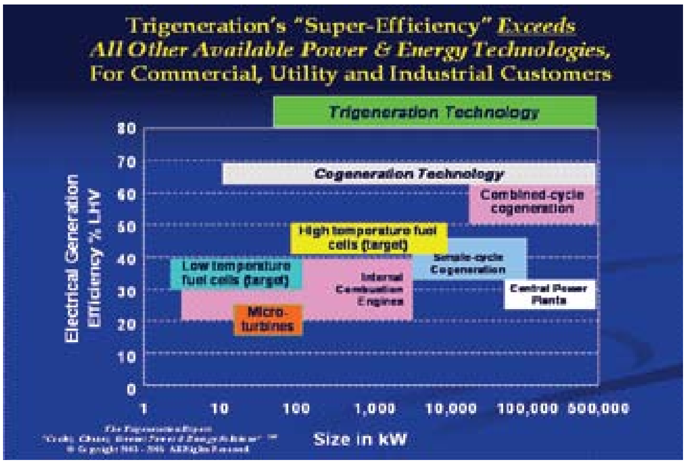
1. Steam generators to a side arm heater or immersion coil (so that all condensate is returned)

2. Thermal fluid heater to a heat exchanger for water or steam generation

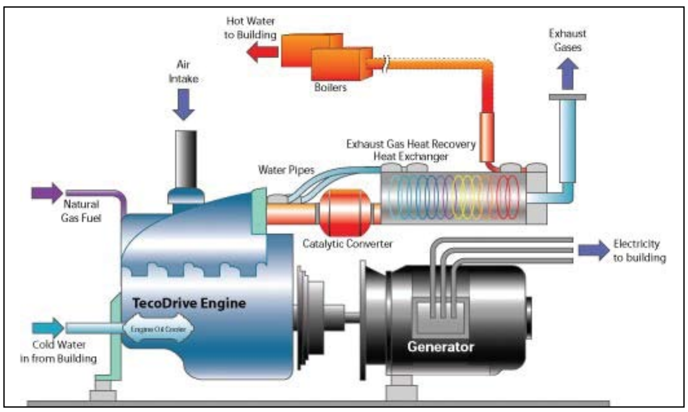
3. Direct contact hot water heater for process water and for a hot water heat exchanger for re-use water reheating (closed loop system)

So far, the idea appears promising with the overall Btu per pound of linen being about 30-50% less than a conventional steam laundry. Given the lower process temperatures and pressures in North America, these savings may not be as dramatic, but they are still worth serious consideration when looking to renovate or build new. (Watch for an in-depth article on this topic in the near future!)

Cogeneration:
Cogeneration now produces almost 10% of our nation's electricity. It saves its customers up to 40% of their energy expenses, and provides even greater savings to our environment.



The chart above documents the efficiency of cogneration systems vs. other methods of producting electricity.



A schematic view of a cogneration system

Cogeneration, also known as "combined heat and power" (CHP), cogen, district energy, total energy and combined cycle, is the simultaneous production of heat (usually in the form of hot water and/or steam) and power, utilizing one primary fuel. Cogeneration is a proven technology that has been around for over 100 years. Our nation's first commercial power plant was a cogeneration plant designed and built by Thomas Edison in 1882 in New York.


A view of cogeneration equipment

Primary fuels commonly used in cogeneration include natural gas, oil, diesel fuel, propane, coal, wood, wood-waste and biomass. These "primary" fuels are used to make electricity, a "secondary" fuel. This is why electricity, when compared on a Btu to Btu basis, is typically 3-4 times more expensive than primary fuels such as natural gas.

A typical cogeneration system consists of an engine, steam turbine, or combustion turbine that drives an electrical generator. A waste-heat exchanger recovers waste heat from the engine and/or exhaust gas to produce hot water or steam. Cogeneration produces a given amount of electric power and process heat with 10%-30% less fuel than it takes to produce the electricity and process heat separately.

As you can see, there are many options and variables that you should be aware of regarding the issue of energy efficiency. Some of these ideas and technologies already are present in the textile services industry in North America, while others are NOT yet established. In these times of high energy costs and ever-increasing fees for water, applying a common-sense approach to these technologies is the best way to go.

Evaluate carefully

The one word of warning here that I want to share with my industry peers is this: Make sure you evalaute all of the above ideas with the "total plant solution" in mind. Some or none of the ideas outlined above may apply to your facility. A lot depends on what kind of plant you're running, building or thinking of building/retrofitting. Heavy industrial to light-soil healthcare will demand a different solution, due to the nature of your work mix alone. And, as the costs of water and energy vary greatly across the United States, so too will your rates of ROI on systems designed to save energy and water. However, having investigated and done your due diligence with an industry professional at your side, some combination of the above CAN be designed to suit your particular facility. **TR**

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