

# Early Payoff with Boiler Conversions

## New Boiler Technology Worth Evaluation



The profitability of a retail building depends in part on the operating efficiency and reliability of a central boiler plant.

**Y**our boilers are in the basement or deep in the heart of your building, in a place people don't visit very often. They keep chugging along year after year, doing what they're supposed to do. There are many other projects demanding your time and budget dollars. But if you haven't evaluated your

boilers lately, with an eye toward an upgrade or conversion, you may be making a mistake. You might miss a very short payback in your building maintenance and energy budgets.

### OIL-FIRED BOILERS A PRIORITY TARGET

Many commercial buildings still use oil-fired boilers firing

#2, or a heavier grade oil such as #4 or even #6 oil. These boilers should be priority candidates for conversion or replacement with natural gas-fueled boilers for several reasons. First of all, oil has historically been more expensive than natural gas in many markets. Furthermore, older oil-fired boilers are generally far less efficient than new gas-fired systems, especially if they are a decade or two old.

In comparing the operating economy of your old oil boilers with those available with today's new natural gas designs, the combustion efficiency of the oil boiler is only part of the equation. According to Dr. Herbert Eckerlin from the Department of Mechanical and Aerospace Engineering at North Carolina State University, the practice of estimating the efficiency of an oil-fired boiler by just doing stack testing is not enough. It ignores parasitic losses unique to oil firing. These are the additional energy needs and operat-

### AT A GLANCE

- ▶ Reduce operating costs by converting oil-fired boilers
- ▶ Many parasitic losses eliminated by conversion
- ▶ Today's package boilers compact and efficient
- ▶ Meeting emission standard an important goal

ing costs that are not reflected in the boiler fuel cost itself.

### PARASITIC LOSSES ADD UP

Eckerlin feels that these losses typically add an additional efficiency penalty of six percent or more on top of the raw boiler efficiency. This can depend on the type of system, its geographic location, and the exact characteristics of the oil fuel. None of these oil-firing penalties apply to natural gas.

### UNIVERSITY COMPARES NATURAL GAS AND OIL

One facility manager that goes to extra efforts to understand the true cost of oil vs. natural gas is Kurt Bresser at Temple University in Philadelphia. The University has two steam plants which are normally fired by natural gas but have a dual fuel capability because of an interruptible gas contract with the local gas utility, PGW. Bresser says he has the option to switch to oil at any time, but needs to know the full cost of that decision. He looks not only at the parasitic energy losses, but also considers that he has to have two workers in the mechanical room when firing oil, but just one with gas. Another reality is that the emission charges from the local air quality district are three to four times higher with oil. Bresser says, "It's an economic decision, but you need to look at a lot of factors. Usually, gas comes out ahead."

#### PARTIAL LIST OF GAS BOILER MANUFACTURERS

BRYAN BOILERS	<a href="http://www.bryanboilers.com">www.bryanboilers.com</a>
BURNHAM HYDRONICS	<a href="http://www.burnham.com">www.burnham.com</a>
CLAYTON INDUSTRIES	<a href="http://www.claytonindustries.com">www.claytonindustries.com</a>
CLEAVER-BROOKS	<a href="http://www.cleaver-brooks.com">www.cleaver-brooks.com</a>
CROWN BOILER CO.	<a href="http://www.crownboiler.com">www.crownboiler.com</a>
FULTON	<a href="http://www.fulton.com">www.fulton.com</a>
JOHNSTON BOILER CO.	<a href="http://www.johnstonboiler.com">www.johnstonboiler.com</a>
LOCHINVAR CORPORATION	<a href="http://www.lochinvar.com">www.lochinvar.com</a>
MIURA BOILER	<a href="http://www.miuraboiler.com">www.miuraboiler.com</a>
PARKER BOILER CO.	<a href="http://www.parkerboiler.com">www.parkerboiler.com</a>
PEERLESS BOILERS	<a href="http://www.peerlessboilers.com">www.peerlessboilers.com</a>
SUPERIOR BOILER WORKS	<a href="http://www.superiorboiler.com">www.superiorboiler.com</a>
THERMAL SOLUTIONS	<a href="http://www.thermalsolutions.com">www.thermalsolutions.com</a>
WEIL-MCLAIN	<a href="http://www.weil-mclain.com">www.weil-mclain.com</a>

MORE INFORMATION

Eckerlin and other researchers over the last two decades have identified penalties including the costs of maintaining and operating oil storage systems, tank heating, pumping costs for in-tank agitation and delivery to the burner head, and the energy used in atomization and in necessary additional boiler cleaning.

The losses can be as subtle as the cost of energy in the steam or compressed air used for soot-blowing. Researchers have also documented additional economic penalties with oil-fired units such as the reality that users need to pay for their fuel after it is delivered, rather than after it is used. Some owners have to pay an inventory tax on the oil in storage. All of these losses must be considered.

### PACKAGE BOILERS IMPROVING IN EFFICIENCY

One of the important changes has been development of efficient gas-fired package boilers in increments that make sense for many commercial buildings. Owners install these in various increments of capacity to meet current and near-future year-round needs.

This approach, using quick-starting package boilers, allows these facilities to operate efficiently at different times of the day and the year. Manufacturers today offer unit modulating packages that optimize the usage of the right boilers at the right time for maximum efficiency. In their planning, commercial building managers should allow space for future package boiler additions, as needed. This space may not have to be large, as modern horizontal and vertical package boilers are much more compact than earlier units.

### TECHNOLOGY HAS NEW TOOLS

Not all commercial building operators are aware that there have been significant advances in boiler technology. In the last ten years there has been a remarkable level of improvement in this venerable product. One thing that has changed the playing field is energy costs. Designers have placed a higher priority on efficiency. Modern com-

puter modeling tools have made it possible to achieve new levels of performance and to further reduce emissions. According to Steve O'Connor from Cleaver-Brooks, "Facing the challenge of the 21<sup>st</sup> century to generate steam or hot water... requires advanced engineering practices using sophisticated technical and modeling tools."

### COMPLYING WITH EMISSION STANDARDS

In selecting a replacement boiler system, it's important for your contractor or engineer to be aware of present and future air emission limitations. In certain parts of California and Texas, new boiler installations for commercial buildings must meet rigorous standards for NO<sub>x</sub> emissions. Practically speaking, this means natural gas is the only allowable fossil fuel, and an ultra-low NO<sub>x</sub> burner will be required. A large number of manufacturers offer boiler burners that meet these restrictions.

Manufacturers offer modern steam and hot water boilers well-adapted for use in commercial buildings. These boilers feature advanced metallurgy, digital controls, and designs based on computer modeling of the combustion, steam flow, and flame characteristics.

With these advanced design tools, owners are finding boilers with actual operating efficiencies well above 80% and turndown capabilities of up to 5:1. This means that the boiler will still operate efficiently even when running at low load. These levels of performance are achieved with NO<sub>x</sub> emissions below 30 ppm, which meets most standards. If ultra-low NO<sub>x</sub> compliance is necessary, a number of manufacturers offer burners that can achieve levels of 10 ppm or lower.

### BOILER CONVERSION CAN LOWER EMISSIONS

Even if you are not in a strict air emissions zone, with an oil-fired boiler you

may be emitting levels of NO<sub>x</sub> and SO<sub>2</sub> that are environmentally unacceptable. By converting from oil firing to natural gas, you will be gaining the space previously needed for oil storage, pumps and related systems.

An evaluation of your entire steam or hot water system will allow you to determine if the system is still sized correctly, and can still operate at peak efficiency year round.

### CHECK GAS BOILERS AS WELL

Much of the above discussion has focused on oil-fired boilers. Don't forget to evaluate your existing gas-fired equipment as well. Pay special attention to older gas-fired boilers, and to any boiler more than 10 years old. Even though an existing gas-fired boiler may have many years of expected remaining life, it may be worth it to look at upgrading the boiler burner with one that could lower emissions and possibly improve combustion efficiency as well. For example, two divisions of the John Zink Company, the Todd Combustion Group and the Gordon-Piatt Group, offer state-of-the-art burners suitable for both new boilers and for burner retrofit situations.

It's easy to postpone replacement on an older boiler that is still operating satisfactorily. But it is better to do the evaluation now and make that decision based on knowledge. Your engineer and your gas utility can help you do the evaluation. This year is a good time to start.

### The many energy and economic loss points of a typical oil-fired boiler.

