# Why a hybrid boiler system?

A hybrid boiler system combines the lower operating costs of a condensing boiler system with the lower equipment cost of a non-condensing boiler system. A hybrid boiler system combines both types of boilers to their maximum advantage. Hybrid boiler systems are based on three principles. First, is that boiler systems are oversized for the vast majority of the heating season. Second, is the concept of outdoor reset control. Third, is the knowledge that as boiler water loop temperature increases, the ability of a boiler to condense decreases - as does its efficiency.

Boiler systems are designed to warm buildings to a comfortable level during the coldest expected days of the heating season. For the remainder of the heating season, the boiler system is oversized for the required heat output, and the system operates at a fraction of its capacity. During the warmer days of the heating season, not only is it possible to operate fewer boilers at reduced firing rates, it is also possible to keep the building comfortable with lower temperature water flowing through the heating system. An operating concept known as outdoor reset takes advantage of this relationship between changes in outdoor temperature (and thus changes in building heat loss) and variable temperature in the boiler water loop. .

When it is relatively warm outside, boiler loop temperature can be reduced to levels where condensing boilers will condense, and hence offer the greatest payback on their investment. A condensing boiler condenses when the flue products of natural gas are allowed to cool below their dew point of 130°F. The greater the amount of flue products cooled below 130°F, the greater the amount of condensing that occurs in the boiler and the higher the boiler efficiency.

The temperature of the water entering the boiler determines the minimum flue temperature possible. Naturally, if you want the boiler to condense at all, entering water must be at or below 130°F. Again, it is possible to keep a building comfortably warm with colder water in the boiler loop when it is relatively warm outside. However, as outdoor temperature drops, the building heat loss increases and it is necessary to increase boiler loop temperature to maintain building comfort. As boiler water temperature rises and the water returning to the boiler is warmer than 130°F, condensing boilers will stop condensing, and their efficiency drops. During the coldest days of the heating season it is common to operate boiler loops at 180 to 200°F. At these water temperatures, a condensing boiler will operate at an efficiency level that is only marginally higher than a non-condensing boiler.

Operating condensing boilers when boiler loop temperature is too high for condensing to occur reduces the return on investment of these comparatively more expensive boilers. A method of maximizing the return on investment of a boiler system is to use less expensive non-condensing boilers to supplement the heat output of the boiler system, when outdoor temperature drops and boiler loop temperature rises. These hybrid systems prioritize the operation of the condensing boilers when loop temperatures are low. The condensing boilers are dedicated “first-on” boilers and the non-condensing boilers are dedicated “standby” or supplemental boilers.

The hybrid approach to boiler systems can save building owners tens of thousands of dollars in initial equipment cost while providing very high efficiency when operating conditions allow. Payback on the investment of a hybrid system will occur more rapidly than an “all condensing” boiler system. Properly designed, a hybrid system will operate the condensing boilers during most of the heating season, providing most of the Btu output at the highest efficiency. The lower cost and less efficiency non-condensing boilers will operate occasionally, supplementing boiler output with a lower capital cost.