Microprocessor-based controls for HVAC: Meeting environmental, economic and social goals

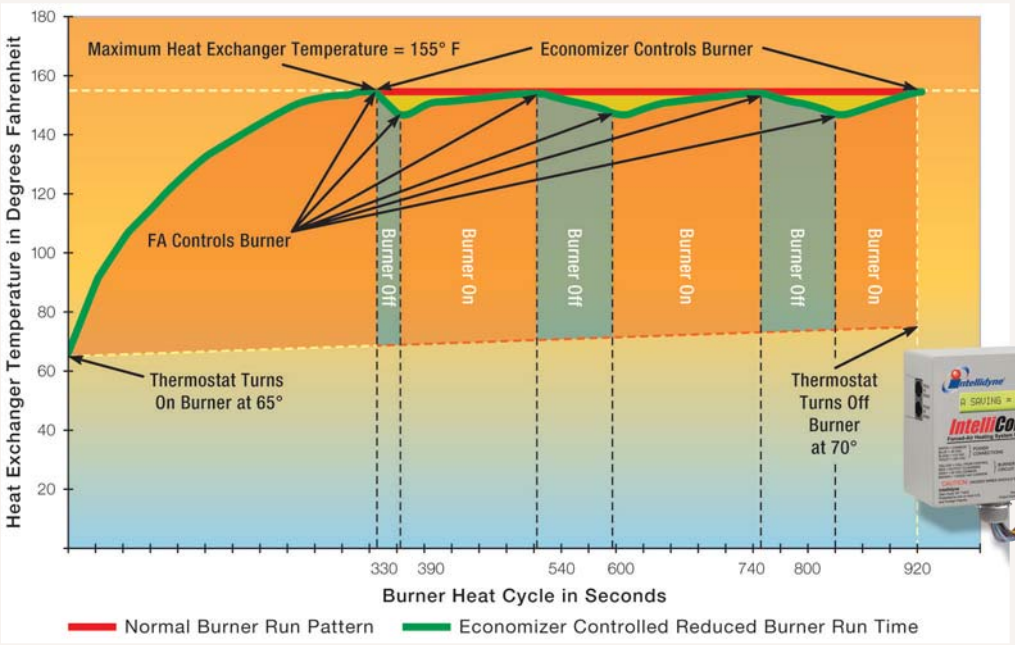
The sustainability movement emphasizes a triple bottom line in which the environment, economy and the social order are all served by going green. In the HVAC industry, that translates into the use of leading-edge control technologies, such microprocessor-based economizer controls. These are being used to achieve the maximum in fuel-saving system efficiency and pollution reduction, while also addressing owner and facility manager concerns about reducing the costs of HVAC and water heat and providing maximum comfort and temperature control within the interior environment.

One of the ways in which microprocessors are used to create environmental and economic efficiencies is through dynamic cycle management. Proprietary technology is now available in energy economizers to efficiently reduce the energy needed to run boilers, forced air heating and compressor-driven cooling systems via real-time "load" analysis and control. They do this by analyzing the system load and then modifying the normal burner run pattern, dynamically adjusting the length of the cycle, so the cycle offers a more efficient use of the heating or cooling system. (See the accompanying graphs.) This will provide subsequent reductions of energy consumption, wear and tear on the equipment, maintenance requirements and pollution release. Such products should be UL-listed as energy management equipment.

Controls for increased efficiency are specific to the task. The top three (black) controls are commercial units for (l to r) hot water, steam and AC electrical. The foreground (gray units) include (l to r) an AC economizer, hot water and forced air units.

Environmental benefits

One leg of the sustainability triad includes environmental benefits. Such systems naturally afford savings achieved from the reduced use of fuel or electricity, but they also offer a re-



The Intellidyne LLC fuel economizer modifies the normal burner run pattern, dynamically adjusting the length and number of cycles while providing the same heat load to reduce fuel consumption. This example shows a normal burner run pattern of 920 seconds, with three 60-second economizer off-corrections, saving 180 seconds of burn. That would equal almost 20% in runtime saved.

duction in negative environmental effects on the planet; ease the burden on natural resources; and help reduce pollutants. Some systems can offer between 10% and 20% savings, with an average measured energy savings of 13%. Indeed, some manufacturers guarantee a 10% reduction up front, with most users realizing greater benefit.

These savings data should be validated by performance testing at independent, third-party testers such as the Brookhaven National Laboratory, the New York State Energy Research and Development Authority (NYSERDA), ETL, Freeport Electric and the Canadian Energy Conservation Group.

One microprocessor-based control manufacturer found CO reduced by a measured 50%, particulates by 40% and hydrocarbons by 30% or more, according to NYSERDA.

Economic benefits

But the three-legged stool of triple bottom line sustainability is supported by more than just a product line's benefits to the environment. As mentioned above, the economic leg is also essential, and a viable system should be documented as a way to save. During these tough economic times, building owners and facility managers need to find ways to reduce operating costs.

The use of a microprocessor-based control in a line of HVAC products can save from 10 to 20% in costs, a significant amount in any building's budget. And payback is seen in as little as a few months to two years.

Microprocessor controls also save on operations by reducing maintenance and extending equipment life, allowing heaters to perform at the optimum for a longer lifespan. And a microprocessor can be used in new construction or in retrofits, so owners can realize savings after just a simple installation by a qualified installer. There should be no extensive upgrade or need to purchase additional equipment.

Once the microprocessor is installed, it probably will not require additional programming or expensive follow-up maintenance. Also, to be economically responsible, a long-lasting comprehensive warranty against manufacturing defects, as well as a product that can be installed without voiding current warranties, is a plus.

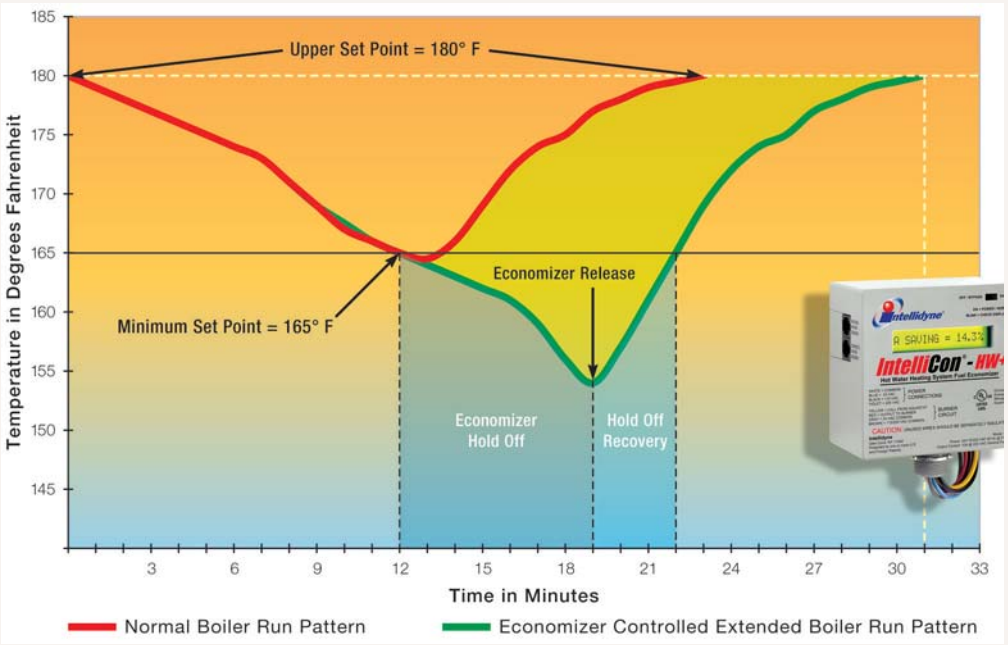
Social benefits

The third factor in supporting a triple bottom line HVAC system is the social leg. One advantage of the microprocessor-based control system is its real-time function. Each control is aware of current conditions, and its ability to respond to that reality and fine-tune operations means that the environment within the building will achieve maximum comfort. Thermal discomfort is one of the biggest sticklers in making the modern office or plant worker happy. Furthermore, temperature control is vital in maintaining maximum productivity on a production line. The stability offered by the microprocessor-based control helps workers achieve maximum performance and reduces illness turnover while assuring a quality performance outcome.

In many cases, an illuminated LCD display on the control gives operations workers and other end-users an immediate readout on the percentage of fuel the control is saving. The display offers information on operating modes, system diagnostics and operating temperatures and lets the staff understand instantly what is happening within the system, the benefits derived and the actual performance of the microprocessor-based control.

When choosing such systems, it is important to look for a technology that is versatile enough to be used in myriad ways, from forced-air heating to commercial and light commercial water and steam heating to air conditioning and refrigeration, for a full-system approach to energy efficiency and pollution reduction.

When these three elements—environmental, economic and social—are considered, almost any HVAC system, new or existing, can reach important sustainability goals through the use of a microprocessor-based control system.



The Intellidyne LLC fuel economizer saves by regulating the timing of the burn. This example shows a 7-minute delay with a 3-minute recovery. That would equal 4 minutes of burntime saved. Dividing that 4 minutes by the adjusted extended run time of 28 minutes (or 31 minutes total minus the 3-minute recovery time), would equal a savings of more than 14% in runtime.