56

Lack of effective maintenance causes excessive energy consumption

It has been said that the best place to hide an object is in the most obvious place because the person seeking it will never think to look there. This saying may also apply to current energy-saving efforts.

In recent years practitioners in the energy conversion disciplines and aware citizens from every walk of life have heard voluminous commentary regarding energy conservation. Government agencies concerned with addressing problems ranging from inflation to unemployment, to gross national product, to national defense; corporate executives concerned with the effects of the rising price of energy on product costs; and homemakers concerned with rising utility bills have all taken steps in their own way to instigate energy conservation programs.

These efforts range from turning the thermostat down to driving no faster than 55 mph, to writing energy conservation standards, to expending millions of dollars on development of energy conservation programs and research aimed at development and utilization of nondepletable sources. An assessment of the potential success of these measures, based upon national depletable consumption statistics, is most disappointing. The least encouraging picture is that of conservation efforts in building systems.

Systems difficult to manage

The reason is that a building system, in addition to being a highly complex energy-consuming entity, is extremely difficult to manage from the energy standpoint. The management responsibility transcends numerous elements of responsibility and technical understanding. As an example, a system designer may accomplish the design of a highly energy-efficient system; but if the installing agency or the operating management do not follow the designer's documents or operating intentions properly in every respect, the system may perform acceptably well but consume significant amounts of energy in excess of the designer's predictions.

It is only natural that for one to look to modifications, retrofitting, investing money to save money, effecting schedule changes, etc. when instigating an energy conservation program in an existing building. These are productive changes easily identified from the standpoint of spending money for a tangible purpose or effecting efforts that can be seen. But numerous experiences in putting energy management programs in effect have revealed that significant conservation can be accomplished by looking in the most obvious place.

Identify system operation

To clear away some of the factors that may be hiding conservation opportunities, the initial step is to identify exactly how the system is operating and then take the necessary actions to achieve operation in the manner conceived by the original designer. During this process, it is generally found that a significant amount

of excess process energy is being consumed because controls and the controlled components are either maladjusted or are not functioning in the manner intended. These include such control system features as setpoint, reset adjustments, throttling range (sensitivity), calibration, relay ratios, damper linkages, and actuator operation.

If any system designer were to conduct an in-depth investigation of, say, ten systems he had designed over a span of the past ten years, it would be unusual if he would find one system currently operated and controlled as intended. It it difficult to generalize in establishing causes for this. However, some possibilities may be a lack of understanding (or education) on the part of the operating management, lack of motivation of any responsible agency, and lack of concern or understanding of *systems* on the part of servicing agencies.

Investigations cited in examples

These conclusions are based on numerous investigations of systems serving commercial buildings, institutional buildings, and campus complexes—ranging from systems that have just been started up to ones that have been operating for two decades. Some examples of personal observations are:

- *Damper leakage in multizone units*—A recent investigation of energy consumption on a college campus revealed that a false load on a cooling system of approximately 700 tons was imposed by leakage of dampers in multizone units. The energy to serve this false load was generated by a boiler system consuming about 11 million Btuh of fuel energy.
- *Calibration of controllers*—An outdoor air-sensing controller in a large office building, which indexed the fan system logic from summer to winter mode, was found to be seriously out of calibration. Consequently, the outside and return air economizer damper remained in the 100 percent outdoor air position during all the warmer months while chilled water was being supplied to the coils.
- *Main air leakage in pneumatic systems*—A leak in an air main caused excessive compressor operation that resulted in oil carryover into the control system. The resulting malfunctioning of control devices led the system operators to respond by essentially aborting the automatic operation and "controlling" a large building system manually at the expense of both excessive energy use and poor performance.
- *Improper adjustment of reset controller*—The improper adjustment caused a wild perimeter heating system to continually overheat during the unoccupied cycle. The operators responded by continually operating the system on the occupied cycle, thus consuming excessive amounts of energy in fan operation and outdoor air heating.

These are just four examples of many, and most have been observed numerous times.

Another germane point is that in all of the above examples (as well as many others), the systems were serviced regularly—some under contract by seemingly responsible service agencies.