SECTION XI

Maintenance management and reliability

The most fundamental requirement of the effective management of energy systems in buildings is the successful management of maintenance and operation of the machinery and systems.

Management of maintenance requires skills in virtually all the areas normally identified with building business management such as finance, real estate, cost accounting, and personnel; and it additionally requires a thorough knowledge of the technical aspects of the systems. Few building managers possess all of these necessary skills, yet the majority of building systems have operated successfully for years. This evident contradiction should be addressed.

Those systems that have operated successfully with a complete lack of well-directed management have done so at the expense of at least one but usually all of the following:

- reduced level of performance;
- significant increase in energy consumption;
- excessive cost of service and repairs;
- reduced life of the machinery.

The reduced level of performance has generally been used as the ultimate meter of successful building system management because of the ease of identification and record keeping. The measuring device has been the *complaints* or *trouble calls*. A *complaint* is when a tenant or occupant of the building contacts the management and reports a discomfort of the occupants being *too hot, too cold, too dark, too stuffy*, or the like. Since to most managers, complaints are somewhat of an annoyance, the natural and normal reaction has been to minimize the complaints. Complete success in eliminating complaints has been observed as an undesirable goal in some cases. There was one commercial building manager, for example, who had developed a technique for evaluating his own management success on an ongoing basis by relating it to complaints. Too many complaints indicated to him that he was not providing adequate service, and therefore ran the risk of having chronically dissatisfied tenants (which could affect his revenue). Two few complaints indicated that he was very likely spending more money than necessary in providing for the comfort of his tenants. His

theory, simply, was that the number of tenant complaints had some point that served to optimize the management economics between revenue and expenses.

Another problem relating to a complete lack of complaints has been observed in building systems management. In the vast majority of instances, the executive level of building management has had a complete lack of knowledge of the technical aspects of mechanical and electrical systems. As a result, they have had to place total reliance upon a maintenance man or staff (consisting of semiskilled technicians). The value of these technicians has historically been measured by their ability to solve problems. If there were no problems (complaints), their value could not be measured. The technicians, in order to be recognized for their true value, needed problems to solve that were visible to both the tenants and the executive level of the management team.

This aspect has another facet which has posed a major obstacle to effective system maintenance. The individual who needs the recognition (for whatever reason) of having solved the problem is psychologically incapable of performing preventive maintenance. There are many such individuals who are totally incapable of preventing problems from occurring, but who thrive on the opportunity to handle the catastrophe once it occurs.

The increase in energy consumption resulting from misdirected management has not only not been a meter of performance, but has not been considered as a controllable variable. Historically, managers of buildings have considered energy costs as an expense beyond their control. A good indication of this attitude is the accounting procedures used in virtually all businesses which contain a building and its attendant expenses. The accounting systems in most cases have placed the energy, if it was purchased from a utility company (gas, electricity, district steam, district chilled water), all in the general category of "utilities" along with water, sewer, etc.; the purchase of other energy commodities such as fuel oil, has often been either included in utilities or in the category of "building supplies" along with soap, deicing salt, etc.

Systems designers in the past have, understandably, been motivated to first, provide adequate size or capacity in the machinery and systems, and second, provide for ultimate control of the temperatures almost irrespective of energy consumption. When the systems were improperly operated or inadequately maintained, the performance was still achieved but at the expense of excessive energy consumption. Examples of this observation are discussed in the chapter, "Lack of Effective Maintenance Causes Excessive Energy Consumption." Since the executive level of management lacked the understanding that something could be done about the excessive energy consumption, this problem was simply not revealed.

The problem of excessive cost of service and repairs is somewhat similar to that of excessive energy use in concept. Most building management teams include a level of executive management (which is skilled in real estate, building finance, and handling problems with building occupants) and a level of technical management which in the majority of cases consists of semiskilled mechanics or technicians whose responsibility is to keep the machinery running. For repairs of major machinery or complex subsystems (chillers, pneumatic controls, prime movers), the technical management people learn to rely upon outside service agencies who unfortunately are motivated to generate accounts receivable by *selling* service. The management mistake is made when the building management team delegates the diagnostic evaluation to the outside service agency. The end result is, more often than not, that service costs are excessive, but management is convinced that these are uncontrollable costs—after all when a chiller is *down*, it must be fixed.

A case history example of this problem is a large high-rise commercial office

building which had been spending as much as $120,000 per year for service on a control system. After the management employed a consulting engineering firm to perform the diagnostic services on all machinery and systems, this average annual cost dropped to less than $2,500!

The chapter, "Designing for Reliability," perhaps more than any other in this book, addresses the integration between the contributions of the building manager and the systems designer. On one hand, if the designer does not consider reliability in the design of the systems, the management team will likely have much difficulty in operating the system reliably at a reasonable cost. On the other hand, it is often the building owner-management team who, lacking an understanding of a good engineer's potential impact upon these operating problems, forces the designer to put all these considerations aside and consider *only* performance and investment cost in design decisions. Even more unfortunately, as many buildings are designed, the energy systems designer is isolated from the owner-manager by a third party such as the architect or construction manager who unfortunately may not understand the extreme importance of an intimate interrelationship between the system designer and the owner-operator.