

## SECTION VII

# Financial considerations

The study of financial considerations related to engineering decision making is commonly referred to as engineering economics. This subject has been rather well structured, a number of excellent texts have been published on it, and courses in it are offered in most engineering curricula. Thus, it is not intended in this publication to provide principles or fundamentals of engineering economics.

In the building industry, unfortunately, there has been a serious lack of understanding and communication between the responsible design engineers and the owner agencies. Although the designer may be fully skilled and educated in engineering economics, the owner agency generally does not look to the engineer for participation in the financial decision-making process. As a result, the decisions are made independently of the engineer or his input, and the results of these decisions are provided to the engineer as design constraints. These constraints often take the form of forcing the first cost down to an unreasonably low level, dictating energy sources, etc., all of which may not be to the long-range benefit of the building investment.

The owner agency concerned first and foremost about a wise investment has no intention of making major financial decisions without the benefit of all the helpful input he can obtain. The unfortunate situation is that this segment of the building team has never been made aware of the tremendous impact that decisions made by the designer can have upon operating costs, and consequently upon the financial viability of the entire building venture.

Numerous major building developments in recent years have failed financially as a direct result of insufficient cash flow resulting from unanticipated energy costs or energy systems maintenance costs. Many others which are owned by public or private institutions would have failed had the buildings had to survive in the commercial money market. It was such a commercial project financial failure that stimulated the author to develop the bidding procedure discussed in two chapters in this section.

In the majority of these failures the designer has unfortunately and unjustly been criticized, when the true fault lies with the institutional structures of the building

industry. Perhaps the exponentially rising costs of energy since 1973 will have a beneficial effect in this regard. Most building owners have begun to realize that energy costs are not simply a business cost based upon statistical norms, but rather, they are a truly manageable cost item, and that the first step in this management chain for a new building is to design to a given energy consumption. This is a concept heretofore that was virtually unthought of.

If this new era of communication comes to pass, the engineer must be prepared to participate. Many earlier efforts of some engineering practitioners to create an involvement in the financial aspects of the projects have failed rather completely, with the disappointed engineer being convinced that the investor or owner agency was not interested in his involvement. The fact of the matter was that the engineer was armed with his textbook knowledge of engineering economics, but totally lacked an understanding of the business methods of the building owner.

There are an untold number of ingredients in the economic formulas relating to buildings, and these are different for the many different classes of buildings. As an example, in commercial buildings, the variable ingredients include investment tax credits, corporate or individual income tax structures, cost of money, availability of equity, alternative uses for available funds, and many others. In many institutions, there is little impact from tax structures, but the invested monies and operating funds are totally unrelated sources—thus expenditures in one area to save in another cannot be justified!

This complex problem has been worsened by the promulgation of concepts and data on techniques called, popularly, “life-cycle costing” by numerous federal agencies. Many of these concepts fail totally to address the complex problems stated above and deal in theoretical or statistical monetary terms which only a governmental agency can accept as valid. The engineering community is not properly informed of the limitations of these concepts and, as a result, suffers more frustration.

The key, then, for success in the communication between the engineer and the owner agency is for the engineer to first inform the owner of his ability to optimize between investment costs and straight cash flow operating cost, and second, to obtain all possible information on investment criteria from the owner, then, finally to develop a technique to enable him to satisfy the owner’s criteria.

When the chapter “Investment Optimization” was originally published, the author received numerous critical comments from economists and other proponents of more sophisticated investment/return techniques. Suffice it to say, that from the standpoint of economic theory or practice, the straight payback procedure used in the technique is not valid in and of itself. But the fact is that the owner agencies for which this purchasing technique was used were all able to ingest all of the complex variables relating to their specific investment, and to express the output *in terms of equivalent straight payback!* Had the author tried to become the financial analyst and have the satisfaction of handling all of the pure economic data (tax base, availability of funds, etc.), the benefits of the experiences related in these chapters would likely not have come to pass.

The message which is paramount in this section is that the engineering practitioner must learn and understand everything he can about economic considerations; he must instill confidence in his knowledge of financial matters with the building owner agency, and he must then accept whatever data that agency can provide and incorporate *that* data into the design parameter formulas. Expressed more briefly—he must be flexible in his approach to the financial parameters.