SELECTING AN ENERGY MANAGEMENT SYSTEM

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KEYWORDS

Energy, Management, Buildings, Selection

ABSTRACT

This paper examines the features, attributes and limitations of available systems and discusses the factors affecting their suitability for particular types of application from the point of view of the user. It considers system specification, applications software, the man-machine interface, hardware, and supply and cost factors.

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Sommaire

Cet Article examine les caracteristiques, Qualités et limitations de plusieurs systèmes disponiblesafin de discuter des facteurs altérant leurs aptitudes particulières pour divers emplois; du point de vu de l'utilisateur. Nous traitons les charactéristiques fondamentales, l'ordinateur et la programation, l'interaction homme-machine ainsi que la Disponibilité et prix relatif de chaque système.

INTRODUCTION

Whilst energy management systems (EMS) often present an attractive investment opportunity, past user experiences are mixed and success is by no means guaranteed. One of the most difficult problems facing the prospective EMS user is selecting the system which will meet the needs of the application most cost effectively. The market place offers a bewildering abundance of products each apparently claiming a similar range of capabilities and functions, though experience indicates that costs and performances can vary widely even in similar applications (1).

MAIN STAGES IN SELECTION

Preliminary Stages

(a) Building Management Systems are not a panacea. More cost effective, measures may be appropriate before the EMS (2).

(b) A survey of target buildings an will reveal what needs to be done first and what the EMS opportunities are.

(c) The relative importance of the control, monitoring and management functions of the EMS in particular applications will determine the extent of human involvement envisaged.

(d) If the 'management information' emphasis of monitoring is low, an EMS may not be the best solution.

(e) It is essential to develop clear objectives on what the system is intended to do and who will operate it.

Types of Application

(a) The types of building, site and estate will impose different constraints on the employable methods of hardware.

(b) The types of services included will constrain the choice to systems with the appropriate applications software and to suppliers with appropriate experience.

(c) Applications emphasising information will affect the requirements of the operator interface and the central station hardware and software.

(d) Budget limitations restrict the choice to systems which are flexible to expansion and offer low cost initial configurations.

Major Selection Considerations

To ensure the best value for money competitive tendering is often the recommended method of final selection.

(a) The pre-tender stage will comprise a preliminary filtering process to eliminate those systems and suppliers which have little prospect of meeting the requirements of the particular application. This should provide the information required to draw up a provisional tender list.

(b) A system specification is required to obtain budget quotations. These will permit assessment of the likely cost effectiveness of the project and provide an opportunity to re-appraise the decision to proceed.

(c) At tender selection the lowest tender price may not represent the best value for money.

THE SPECIFICATION

A detailed discussion of how to specify EMS is given elsewhere(4). Some general guidance is appropriate here.

(a) Ensure that EMS functional requirements are sufficiently well defined to provide the basis for systematic tender selection.

(b) Ensure that hardware is not so rigidly specified to preclude the identification of optimum solutions by different suppliers. Don't rely heavily on a single supplier in writing the specification.

(c) Avoid deferring detailed consideration of any special software.

(d) Ensure a single focus of responsibility when things go wrong. This normally means a 'Turnkey' project.

(e) Make sure that the supplier agrees a firm but realistic completion date and programme of work, and progress payments phased to provide leverage during the project.

BMS APPLICATIONS SOFTWARE

The number of software options is very large, but it is important to select only those which can be economically justified (5). Two other things are important at selection.

(a) Not all systems can offer the full range of options.

(b) The performance of similar options offered by different suppliers is variable(6).

A convincing way to assure the availability and satisfactory operation of software is to speak to independent users and if possible, see it operating successfully.

Management Report Generation Software facilities offered are widely variable, ranging from simple plant status and alarm logs etc, through fairly comprehensive monthly logs of energy; efficiencies and hours run; to user configurable reports.

THE OPERATOR INTERFACE

Assessment of this interface can play a crucial role in the selection procedure. Though this may be subjective, a number of significant factors can be identified. These are discussed below. The EMS user may be expected to perform the following range of tasks, depending upon the system and application:

a. Display or print the value(s).
b. Switch any item of connected plant to on or off.
c. Modify parameter values in standard software routines.
d. Acknowledge alarms.
e. Disable sensor or control points.

f. Initiate printout of reports.
g. Request graphical display.
h. Configure outstation software.
i. Define or modify graphics diagrams.
j. Re-load system software.
k. Modify or define user written routines.

Tasks (a) to (g) would normally be conducted by the day to day operator, whilst tasks (h) to (k) would more likely be the province of the qualified engineer or manager.

The extent and clarity with which the user is prompted to take appropriate action contributes to the 'user friendliness' of the system. 'Menu' based prompts are the most popular method. Further assistance is provided by some machines in the form of HELP facilities and 'special messages'.

Most of the operator tasks listed above require points in the system to be identified. The methods used for addressing are:

a. Hardware addressing. Here the point is identified by numbers which identify the outstation, card and point.
b. Soft Addressing. In this method points are identified by an alpha-numeric character string which is defined by the user.
c. Mnemonic Addressing. In this method mnemonic codes, allocated by the user, are used to identify points in a memorable way.

Trend logs can provide a valuable source of data. Such information in graphical form is more readily understood than long tables.

Some limited operater interface facilities are provided at intelligent outstations to permit things like local override control and checking functional integrity following maintenance.

The different implementations of the features described are widely variable. The best advice is to run through the operator functions and be satisfied that:

a. Messages, menu entries etc are displayed in clear English.
b. Any mnemonics employed really are helpful to the memory.
c. Responses are prompted in a clear and unmistakable way.
d. Menus don't offer too many or confusing choices at each level.
e. No computing expertise is needed.
f. There is no need for repeated reference to manuals or charts.
g. The volume of typing required is acceptable.
h. Displayed point values are accompanied by engineering units.
i. The number of password levels is adequate for the application.
j. The display size and resolution are suitable.
k. The interface matches the skills of the staff available.

BMS HARDWARE

The different EMS equipment offered by manufacturers is relevant to selection insofar as it affects system costs; realisable hardware configurations; constraints on the initial scale, and flexibility for expansion. Costs are considered chiefly at tender selection when tender prices are known. The other factors are useful pre-tender selection criteria. For selection of EMS most suited to broad types of application, systems may be classified as follows:

a. Centralised Systems. In these systems computer power is concentrated at the central station. The outstations provide signal conditioning and data communications functions only.
b. Distributed Systems. The outstations are intelligent with software to conduct local monitoring and control tasks, possibly including DDC.
c. Autonomous Systems. These systems are a sub-set of (b). The outstations have stand alone capability and can operate indefinitely without reference to a central unit.

SUPPLY

At tender selection more detailed attention should also be given to likelihood that the supplier will be capable of carrying the project through successfully, on time, and of providing continued support after handover.

(a) The likelihood of success is greater enhanced if a supplier has successfully concluded projects with similar equipment before.
(b) One way to be sure that the product is fully developed and working is to see it operating successfully at another site.
(c) To complete a new project on time the supplier must have a sound financial status and be able to deploy the necessary level of resources.
(d) To provide continued support after handover, the supplier should be able to guarantee the availability of spare parts and be able to provide hardware and software maintenance.
(e) The supplier should be able to arrange operator training facilities appropriate to the staff involved.
(f) To avoid unnecessarily heavy reliance on suppliers for simple maintenance measures, suitable user documentation is needed.

Invaluable evidence of supplier's abilities in these areas may be obtained from the experiences of other users.

COSTS AND PAYMENTS

To ensure a uniform basis of comparison the total capital and operating costs of each system should be considered. Operating costs are important because they may vary according to the type of system chosen. Supplier's terms of business sometimes include large progress payments early and their tender prices may reflect such cash flows. For the buyer payments linked to staged commissioning may be better and provide leverage on the supplier throughout the contract.

SUMMARY AND CONCLUSIONS

EMS provide a promising route to better economy in building management, but careful attention needs to be given to specification, selection and project management to improve the likelihood of success.

The growing interest in EMS in recent years has resulted in a wealth of user experience. Many mistakes have been made and practical lessons learned. In addition, more suppliers now have several projects behind them and are more experienced in identifying pitfalls and avoiding unexpected problems as well as having ironed out some early technical and software difficulties. Other users and suppliers therefore command an important body of experience and their comments and advice will be sought at an early stage by the prudent selector.

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Sequence of Construction in Multistoreyed Frames - A Time Dependent Phenomenon

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KEYWORDS

Sequence of construction, Multistoreyed two and three dimensional frames, storey by storey construction, time dependent phenomenon, design forces, soil-structure interaction.

ABSTRACT

Multistoreyed building frames are constructed in stages storey by storey. The loading pattern on the frame due to self weight of members thus follows that of accreted bodies, wherein self weight is imposed on the structure in stages as the construction proceeds. In conventional analysis, the effect of sequence of construction which leads to stage by stage imposition of dead load due to self weight of structural members and other finishing items is often neglected and it is assumed that all the design loads are imposed only after the building frame has been completed upto the roof level and has gained strength and elasticity at a standard age. Apart from this time dependent imposition of dead load, analysis of multistoreyed frames should also include the effects of other time dependent phenomena like change in stiffness of members due to differential ageing of the members and joint behaviour, creep and soil structure interaction with sequence of construction. The effect of non-homogeneous foundation conditions is quite serious even with the sequence of construction.

In this paper, the concept of incremental loading has been discussed and adopting a model of sequence of construction an eleven storeyed three bay frame has been analysed both as a two dimensional and three dimensional frame. The elastic foundation system for the frame has also been considered based on Winkler's foundation model. The results of one step analysis have been compared and certain interesting observations have been made. The effect of various parameters is highlighted. The net change in design moments is clearly brought out. The study reveals the effect of various parameters such as frame idealisation, the incremental loading, and other time dependent properties of members and joints for more accurate assessment of the member forces.