COST-EFFECTIVE EMS OPTIONS FOR SMALL BUILDING APPLICATIONS

by HOWARD MICHAEL HABERMAN, RPA

Reprinted from March 1984 BUILDING OPERATING MANAGEMENT Magazine

"USER-FRIENDLY," YET FLEXIBLE ENOUGH TO MEET CHANGING REQUIREMENTS

"THIS TYPE OF SYSTEM WOULD HAVE COST $50,000 OR MORE SEVERAL YEARS AGO, BUT WE HAD IT INSTALLED FOR LESS THAN HALF THAT AMOUNT. THE COST WAS LOWERED IN SEVERAL WAYS . . ."

Energy management systems (EMS) have become increasingly less expensive to install and maintain as a result of the reduced cost of microcomputers and other components. Also, power line carrier (PLC) technology has become reliable enough to incorporate it into the EMS.

After searching for many years for an appropriate energy management system for a 90,000-square foot office building we operate in the suburban community of South Orange, NJ, we finally found and installed one at a cost that justified the investment.

We were searching for an EMS that:

(1.) Was "user friendly", meaning fairly simple to operate.

(2.) Allowed us to make basic changes in operating parameters easily *(for example, goal temperatures in a specific control zone)*.

(3.) Had unique on/off times for each piece of equipment in order to optimize the use of energy.

(4.) Had duty cycling and demand limiting capability.

(5.) Allowed remote control of the HVAC system via computer terminal/telephone.

(6.) Had battery back-up to ensure the integrity of the system in the event of a power outage of relatively short duration, as well as the ability to notify management, through remote notification, of longer outages and other alarm conditions.

(7.) Was simple to install in order to minimize disruption to tenants.

(8.) Was flexible enough to absorb the effects of changes in tenants' space needs.

(9.) Was upgradeable so that we could expand the system's capabilities without major difficulty or expense. *(The system we chose has the ability to expand to over 2,000 points.)*

(10.) Provided absolute positive verification from within the system that instructions had been carried out. *(This required direct digital control (DDC), often referred to as closed loop control. In DDC, the digital computer controlling the system is directly in the control loop.)*

In summary, we wanted all of the benefits of a hard-wired, sophisticated EMS without any of the drawbacks.

We selected a system designed around an "eight-bit"-based microcomputer, and power line carrier remote control equipment. This type of system is known as a two-way, power line carrier system with "analog capability." The two-way feature means it sends

(continued)

*[**NOTE:** This article contains some material originally published in the July, 1983 issue of* Skylines, *1221 Massachusetts Avenue, NW, Washington, DC 20005.]*

instructions to, and receives information from the equipment being controlled. The power line carrier capability transmits information via the existing AC wiring of the building, not over dedicated wires specifically installed for that purpose.

What makes this system unique, though, is its ability to transmit both analog and digital information in both directions. *(Digital information consists essentially of status reports and operating conditions of the equipment: on/off; numerical information such as temperatures, relative humidity and damper positions is transmitted in analog form.)*

In our installation, the computer monitors the temperature outside the building, as well as in certain selected control zones, and the temperature of the supply air. This information is processed by programs designed to optimize energy usage, and translated by these programs into a "customized" on/off instruction to each controlled HVAC unit.

This type of system would have cost $50,000 or more several years ago, but we had it installed for less than half that amount. The cost was lowered in several ways: A low-cost microcomputer was used, instead of a minicomputer that might have required us to maintain surrounding temperature and humidity within certain ranges; the microcomputer has no such needs.

We also realized significant savings by eliminating the need for a lot of additional electrical wiring. The wiring that was required was limited to small runs from each device being monitored or controlled to a nearby remote control device. More savings were accrued because the system could receive analog information through the power lines. In order to receive analog information through other types of PLC systems, wires have to be run from the sensing devices to the central computer. The ability to receive analog information permits run-time optimization, with the assurance of control over tenant comfort.

Although the operation is simple in concept, it is extremely sophisticated in design and implementation. The computer sends a coded instruction, designated for one particular controlling device, to a microprocessor interface. The computer signal must be received despite interference in the AC lines which carry it. The message is transmitted five times. The controlling device must receive the message exactly the same three out of five times, or else it ignores the message. The system works exactly the same in the reverse route, to verify messages destined for the computer.

"This type of system would have cost $50,000 or more several years ago, but we had it installed for less than half that amount. The cost was lowered in several ways . . ."

An example of the power and flexibility of the system is how we were able to accommodate a tenant's needs for after-hours HVAC. The tenant wanted to be able to turn on the part of the system that affected its offices at any hour and on any day.

Prior to the installation of the EMS, we would have hard-wired an override timer into the tenant's office and a meter into the building office . . . at considerable expense. Instead, we provided the tenant with a small "black box", with a plug on one end and a hand timer on the other end. The tenant keeps the box in a secure place.

When HVAC is needed, the tenant plugs the box into any electrical outlet and sets the timer for the time he wants to keep the system on. The unit then sends a coded signal through the building's AC wiring to the computer. The computer turns on the equipment needed in the tenant's offices, and keeps it on until the designated time is passed, or the "black box" is unplugged. And the computer accumulates override time in a separate file for later billing to the tenant.

In the year that the system has been in operation, we have achieved considerable energy savings. The original cost justification was based on energy savings only during the air conditioning season. Energy savings calculations *(adjusting the use for differences in heating and cooling degree days between last year and this)* indicate a savings that had already justified the purchase after only six months use. In retrospect, it might have been obvious that this type of EMS would also yield significant savings during the heating season, but it was a very pleasant surprise to learn that it did. BOM

Howard Haberman is Vice President of Haberman Building Corp., West Orange, NJ, and has been involved in the operation and management of commercial property since 1973. He is a Certified Public Accountant and BOMA-certified Real Property Administrator.