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E=MC3 Energy Equals Management's Continued Cost Concerns

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Abstract
E=MC^3 Energy Equals Management's Continued Cost Concern, is an essay written by Fritz G. Hagenmeyer, Associate Professor, School of Hospitality Management at Florida International University.

In the writing, Hagenmeyer initially tenders: “Energy problems in the hospitality industry can be contained or reduced, yielding elevated profits as a result of applied, quality management principles. The concepts, processes and procedures presented in this article are intended to aid present and future managers to become more effective with a sharpened focus on profitability.”

This article is an overview of energy efficiency and the management of such. In an expanding energy consumption market with its escalating costs, energy management has become an ever increasing concern and component of responsible hospitality management, Hagenmeyer will have you know.

“In endeavoring to "manage" on a day-to-day basis a functioning hospitality building's energy system, the person in charge must take on the role of Justice with her scales, attempting to balance the often varying comfort needs of guests and occupants with the invariable rising costs of energy utilized to generate and maintain such comfort conditions, since comfort is seen as an integral part of the "service," "product," or "price/value” perception of patrons,” says Hagenmeyer.

In contrast to what was thought in the mid point of this century - that energy would be abundant and cheap - the reality has set-in that this is not the case; not by a long shot. The author wants you to be aware that energy costs in buildings are a force to be reckoned with; a major expense to be sure.

“Since 1973, "energy-conscious design" has begun to become part of the repertoire of architects, design engineers, and construction companies,” Hagenmeyer states. “For instance, whereas office buildings of the early 1970s might have used 400,000 British Thermal Units (BTUs) per square foot year, new buildings are going up that use 55,000 to 65,000 BTUs per square foot year,” Hagenmeyer, like an incandescent bulb, illuminates you.

Hagenmeyer references Robert E. Aulbach’s article - Energy Management – when informing you that the hospitality manager should not become complacent in addressing the energy cost issue, but should and must maintain a diligent focus on the problem.

Hagenmeyer also makes reference to the Middle East War and to OPEC, and their influence on energy prices.

In closing, Hagenmeyer suggests an - Energy Management Action Plan – which he outlines for you.

Keywords
Fritz G. Hagenmeyer, E=MC^3 Energy Equals Management's Continued Cost Concern, Robert E. Aulbach/ Energy Management, Energy efficiency, FIU

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Energy Equals Management's Continued Cost Concern

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Energy problems in the hospitality industry can be contained or reduced, yielding elevated profits as a result of applied, quality management principles. The concepts, processes and procedures presented in this article are intended to aid present and future managers to become more effective with a sharpened focus on profitability.

In endeavoring to "manage" on a day-to-day basis a functioning hospitality building's energy system, the person in charge must take on the role of Justice with her scales, attempting to balance the often varying comfort needs of guests and occupants with the invariable rising costs of energy utilized to generate and maintain such comfort conditions, since comfort is seen as an integral part of the "service," "product," or "price/value" perception of patrons. Unfortunately, the person in charge may remain as blind as Justice when it comes to effectively and practically balancing energy supply, demand, distribution, use, and cost and to reconcile these forces.

It has become abundantly clear that energy consumption, energy costs, and attendant operational ratios are clearly a continuing and often expanding concern to hospitality management on various organizational levels. As such, "energy management" has become more than a buzz-word for appropriate use on the professional cocktail circuit. In close context, energy management is required understanding, a developed skill, and a requisite continual commitment in quality hospitality management.

In a more comprehensive view, "the energy question also encompasses full employment, economic growth, war and peace, and political stability."[1] The energy state and its implications have been seen as the "peace time equivalent of war; that is, something short of disaster which can serve as an incentive to take difficult action for the common good."[2] While theoretical analysis suggests that in the long term, technical fixes alone in the United States could probably improve energy efficiency by a factor of at least three or four.[2] Or, more pragmatically alluring, as Sen. Russell Long, in context with energy allocation legislation testimony stated in 1975, "I do not believe hotels

and motels should be regarded as a non-essential industry, certainly not one to be dispensed with."[3]

In the past, energy costs were substantially lower; it was even thought to be decreasing to the point where the home use of electricity would not even be measured, as it would be so cheap. The assumption was that the manpower cost of reading meters would be greater than the cost of energy which the homeowner conceivably could consume.[4] Many persons in the United States considered energy to be both inexhaustible and expendable, resulting in a seemingly insatiable appetite for and gluttonous consumption of energy. The problems fostered by such attitudes are visibly manifest in commercial buildings including, but not limited to, hotels, motels, resorts, and restaurant and club facilities constructed after the mid-20th century. In New York City, for instance, the sealed glass-enclosed office buildings put up in the late 1960s used twice as much energy per square foot as those put up in the late 1940s. Since 1973, "energy-conscious design" has begun to become part of the repertoire of architects, design engineers, and construction companies. For instance, whereas office buildings of the early 1970s might have used 400,000 British Thermal Units (BTUs) per square foot year, new buildings are going up that use 55,000 to 65,000 BTUs per square foot year.

Typically most such earlier buildings were designed, constructed, and outfitted with initial cost as major consideration. Simpler building structures and uncomplicated control systems enabled operators, managers, and owners to cope with moderate knowledge of day-to-day facilities operations, keeping the energy management job responsibility deep in the background of both understanding and necessity. As a result, valid long-term data on the use of energy in the built environment generally have been weak.

Buildings Are More Efficient

This is no longer true. Increased structural complexity, novel design, new building and component materials and assemblies, assessments on life-cycle-valuations, the use of advanced and technically more sophisticated controls, and sharply increased costs of energy have led to and resulted in more energy efficient new buildings. It is arguable that hospitality facilities development generally has not been in the forefront of supplying energy efficient buildings. The rate of replacement of the existing building inventory and the fact that the majority of existing commercial buidings are designed, built and outfitted without energy conservation in mind, have made conservation of energy and, more importantly, energy cost avoidance matters of serious operational concern. As such, energy management, the former Cinderella job, has telescoped out to a critical management task that often can be accomplished only by adequate understanding, management commitment, and the application of reasonable standards to insure quality work, achievement, and performance control in the energy sector. Energy management in hospitality facilities is management of a "profit center hazard area."

On the positive side, energy management in hospitality management

is considered a legitimate continous challenge beyond just achieving energy conservation. On the negative side, hospitality personnel, as the public at large, may be affected by memory-atrophy, i.e., may only have faint recollection of policy development on gasoline rationing, mandatory allocations and Sunday bans, or severe quotas.

As Robert E. Aulbach cogently states in *Energy Management,*

> even with ever increasing costs, a lack of real concern still exists in many managers. Except for making comments of disbelief when the utility bills are received, some managers do little to more effectively control energy costs, mainly because they do not know how. Other managers may want to do something, but set priorities in other areas. Their rationale is: 'High energy costs are a problem, but so is everything else. We will get around to energy concerns some other day. In the meantime, we will just pass the cost increases along.'
>
> Another negative reaction to the problem is the view that energy and maintenance are cost instead of profit centers. If managers think of energy only as an expense, they may fail to realize that as costs are reduced, profits increase accordingly. A higher priority might be given to energy management concerns if the question "What can be done to increase profits by reducing energy costs?" were asked.
>
> Some managers may be disenchanted about energy management programs because the energy problem is complex. They may not be able to identify energy problems as readily as they can other daily problems because of their lack of knowledge and understanding of the subject. These managers believe that the primary solutions are in hardware rather than in management. There are thousands of salespeople who are inadvertently promoting this misconception.
>
> While these reactions are typical, they are not defensible. The positive management response to the energy problem (and its resolution) is more enlightened. Hospitality managers at all levels in the operation today and in the future must be aware of, concerned about, and active in ongoing efforts to manage energy effectively. Managers are not expected to be energy experts and they carefully cannot do it alone. However, they need to have a solid background in energy management as it relates to all departments.

As in other areas of leadership responsibilities, in these days of more sophisticated management techniques, it is essential that managers reach an understanding of and develop their skills in the areas of cost intensities and the partially uncontrollable forces shaping them that affect every hospitality business "bottom line."

Energy Shortfall Arrived Quickly

It is well known that the energy problem became recognized as a crisis when the Arab oil-producing nations cut off oil supplies to the United States during the Middle East War which began in October,

1973. Even before this embargo, the oil producers in the Organization of Petroleum Exporting Countries (OPEC) had begun to raise oil prices. As a direct result, the "energy shortfall" appeared like an avalanche. Further impetus was provided by the second oil price increase in 1979 that established new increases "greater than those that accompanied the first oil shock."[6] As a result, essentially two basic building energy conservation methods were advanced.

The first (external/non-managed) method involved, in part, governmental interference through implementation of several specific energy end-use restrictions in building operations. This required, for instance, adjustment of thermostats to specific temperature levels in order to conserve heating and cooling energy.[7] The removal of electric lamps and luminaires in order to achieve a reduction of illumination energy consumption was quickly accomplished and widely encountered. Simplicity and ease of initial implementation are the primary advantages of such an approach. After all, it requires very little new education or continued motivational effort to adjust an air or water thermostat to a prescribed setting, to remove light bulbs, or to delamp luminaires. It is however, evident that such an end-use restriction method has numerous drawbacks, particularly affecting hospitality facilities.

End-use restrictions tend to ignore the potentially significant energy savings which can be realized by making systems operate as efficiently as feasible. In a similar manner, end-use restrictions fail to consider the fact that every building and its comprised operations have a unique complex aggregate system in which many components interrelate and are, to various degrees, interdependent. For example, lowering the dishwashing water temperature can cause consumption of more energy, not less. Likewise, removing or derating lamps can sometimes cause increased consumption of energy and other costs of operating the building and, in some cases, a set-down of the thermostats may result in additional heating.

Buildings Are Considered As Unique

The second (internal/manageable) energy conservation approach therefore considers every building as a unique, interrelated complex system. In order to conserve energy and to avoid unnecessary costs, one first must understand how the building's fuel is mixed, how it consumes energy, how this energy and power use is billed to and paid for by the operation, how the building's components and systems operate and thereby occupants' needs are met, what business priorities are established for both short and medium terms, and how owners' objectives are being met.

This approach recognizes, for example, the importance of an energy audit. Confusing, however, energy audits with energy management has become a trend fraught with danger. Clearly an energy audit, standing alone, does not produce energy savings; it is to be simply seen as one of several essential steps in an aggregate, dynamic, and strategic energy management program.

One must also realize in using this approach that there are significant limitations in the engineering and cost accounting techniques that

are commonly used to compute energy consumption. It is, for example, impossible to accurately estimate the savings produced by so-called low-and no-cost actions or minor capital improvements (such as cleaning all heat-exchanger surfaces, or weather-stripping a building) which in the aggregate can save considerable energy.

For any meaningful energy management program, a variety of requisite input data, such as building definition, spatial organization, location and orientation variables, and, especially, internal loads (such as occupancy with related location shifts within the building, secondary occupancy-loads, equipment-use schedules, etc.) are difficult to obtain precisely and may have limited value for energy management. Even the complex computerized methods, AXCESS, BLAST, DOE-2, TRACE, for example, are known to rarely be able to predict actual energy consumption to within 10 to 15 percent. Discrepancies are reported to range from 25 to 50 percent. Thus, calculation error margins can be greater than the effects being calculated.

Fortunately, hospitality management appears not to require complex computerized methods and tools for sophisticated energy management applications at the present. This energy conservation and management approach also recognizes that there are strong regional differences in the type and respective cost of fuels consumed. For example, oil is the primary heating fuel in the Northeast and the Pacific Northwest. Gas dominates the Midwest and Southwest, and electricity dominates in Florida. Even more dramatic differences are evident in the energy cost and its growth (or occasional decrease). For example, reported electrical energy costs for a property using a hypothetical 200,000 kwh a month at a peak demand of 500 kw (e.g. a medium-sized hotel) for December 1984 ranged from a low of $.0187/kwh at Tacoma, WA to a high of $.1195/kwh at San Diego, CA. This amounts to a difference of 540 percent. December price increases of electric energy were reported to range up to 73 percent at Albuquerque, NM (from $.0568/kwh in 1983 to $.098/kwh in December 1984), with the highest cost decrease reported at -22 percent at Tacoma, WA.

For a pragmatic energy management to be effective, it is not necessary to have exact and precise answers; reasonable estimates should be sufficient.

Energy Management Is Increasing

Increasing numbers of hotel and restaurant owners and managers are applying energy management and achieving the many benefits inherent in its application. One major benefit is the focal cost element. As even a brief review of case studies and effort application reviews clearly indicates, many of the most effective energy and energy cost conservation measures require minimal or no capital outlay. Case study after case study shows convincingly that appreciable or significant energy savings can be obtained through effective control, lesser operational changes, improved maintenance, repair or replacement of faulty equipment, installation of minor new components, maintaining increased awareness of the personnel, and other simple procedures.

While national energy consumption continues to grow, there is evidence that energy consumption (but not cost) is down in the nation's hotels for the sixth consecutive year, according to a recent study published by the American Hotel and Motel Association Technical Services Center. Impressive results and laudable goals for energy consumption reduction for existing properties have been announced. While upgrading existing facilities and equipment are expected to accomplish major results, it should be recognized that many important first steps in an energy program, such as establishment of, or changes in, managerial/administrative policies, cannot be simply and easily quantified as to their effect on overall energy use. However, evidence suggests that these actions may have benefit/cost ratios 100 times greater than mere capital improvements,[9] and thus can enhance overall energy management effectiveness. Energy cost avoidance and energy conservation as management responsibility become more critical and cost effective every year.

To assure success an energy management program must be designed to instill conservation awareness in personnel. The main objective of the program is to change attitudes, behavioral patterns, operating techniques, and schedules in order to reduce energy consumption by a realistic margin. Management emphasis, incentives, awards, and recognition are vital to the success and effectiveness of any program to save energy without sacrificing detailed and overall service standards.

Energy, an intangible like service, is an upper management responsibility: "in the final analysis . . . it is management which has to put the proper emphasis on these energy programs."[10] A well-balanced energy management program will cut across internal segmentation and divisions and will require policy changes, improved operations and maintenance and, finally, effective capital investment strategies. An energy management program is not a short term focus and therefore must be financially sound. Progressing from less to more expensive changes often can result in some kind of self-financing program.

Management Program Begins With The Basics

How then can such a program be established and effectively used? In considering the development and implementation of an energy management program, one must go back to basics and answer three fundamental questions:

- How much energy is being used?
- What is the cost of that energy consumed?
- What can be practically done to reduce energy consumption and/or costs?

The answers to these questions will obviously vary markedly with the building, its locations, and its environment, occupation and use pattern, requisite service level, staff and management capability and performance, value to the owner, and other variables.

Regardless of such idiosyncracies and changing variables, an energy management program and its supportive documentation can be sim-

ply developed as an effective management tool to aid all reasonable efforts to reduce energy usage and avoid energy costs. As such, a meaningful, practical energy management program transcends the generation and maintenance of improved thermodynamic efficiencies in production and consumption often called "technical fixes" which could easily result in substantial savings in the energy budget.

An energy management program does not need to be experimental. A number of programs and implementation manuals have been successfully tested in the field and numerous case studies have been reported from the field of hotel and restaurant facilities management.

Although, optimally, an energy management program would be specifically designed for the individual, unique building and facility, then fine-tuned and kept current, one can develop such a program systematically from a basic need-based program and its supportive procedures manual and documentation.

The contents of such a manual should include specific information, a realistic action plan with specific conservation methods and goals for all departments, and job responsibilities. This manual, as a management tool, contains further materials needed to implement the program, e.g. forms, posters, decals. Required simple documentation is to feature a clear and simple tracking system to measure energy use in the facility without continuous monitoring of utility meters. With such a simplified tracking system, progress toward a goal is plainly measured by recording the time each piece of equipment is used. Such a simple energy accounting system converts all mixed energy use to a common measure and then shows the energy usage for each "business unit," e.g., energy used per occupied room, per meal cover served, per pound of linen processed, with weather induced energy consumption and typical uses adjusted for.

This use-time is then converted into its equivalent energy consumption, usually expressed in British Thermal Units (BTUs) or kilowatt hours (kwh). Daily tracking will indicate an increase or decrease in energy consumption in the same manner as a daily meter reading, and may be related to business volume and other conditions. As the program progresses, attitudes are changed, goals are reached, loads and data confidence bands are established, and the need for detailed tracking decreases.

A typical energy management action plan may consist of sets of procedures/actions, primarily designed to modify operating techniques and schedules in a typical hotel or restaurant facility in order to decrease energy consumption while providing services and maintaining a comfortable and reasonably safe and secure environment for all occupants. It should be noted that responsibility for implementing the action plan must be specifically assigned in order to properly account for its progress. Each action should have a defined date to start and a date completed.

A suggested Energy Management Action Plan may appear as follows:

Action One: Program Definition and Introduction

1.1 Develop program overview and explain program

basis and goals to management; secure management commitment.
1.2 Assign responsibility to key personnel.
1.3 Organize and motivate team effort to carry out program.

Action Two: Establish Data Base for Building Energy Profile

2.1 Building/facilities data.
2.2 Weather/climatic data for site.
2.3 Energy consumption records and purchasing procedure for at least two years.
2.4 Operating/maintenance logs and manuals; interrelate with business activities.
2.5 Business activity data (occupancy, food & service volume, supportive operations, etc).
2.6 Management accounting including costs determination and mandated reporting of energy use, if applicable.

Action Three: Inspect the Equipment/Installations Having Substantial Energy Requirements

3.1 Inspect equipment/per department.
3.2 List equipment/deficiencies.
3.3 Correct equipment deficiencies where feasible.
3.4 Initiate actions to replace equipment which is not economically repairable.

Action Four: Track Equipment Energy Usage and Establish Energy Use Profile

4.1 Record actual on/off times of equipment in both departmental and central locations; establish operations-required use-variance patterns.
4.2 Measure and record resultant energy consumption per departmental/central allocations.
4.3 Establish base figures (energy use benchmarks, baseload data, etc.) against which future energy consumption can be compared and the effects of energy management tactics can be measured and evaluated.

Action Five: Monitor the Program, Update it and Keep it Effective

5.1 Assure that optimal levels of energy consumption are reached consistently.
5.2 Assure that levels of initial savings do not decline once initial goals are reached.
5.3 Refine development and control of departmental and functional area based energy budgets by application of energy use standards or "par-values" to allow management to act in response to variance analysis of actual energy use and budgeted energy consumption. This allows

management to effect energy control by treating energy consumption and energy cost as a direct expense of operations rather than an indirect or overhead cost.

5.4 Refine and update checklists for energy conservation and keep related information, both general and technical for periodic reference and potential actions.

Each of these actions must be adequately researched. For example, in obtaining materials for Action Two, energy managers should have certain information on hand before actually setting target-goals and developing strategies to reach these goals. Typically, this information includes:[11]

•**Energy consumption data for years previous to the base year:** Although it is not critical to the conservation program, it is suggested that energy consumption data for the three years prior to the base year also be collected and made available in usable format for purposes of comparison.

•**Weather data:** Weather data should be obtained for each year for which energy consumption data are collected. Weather data usually are available from the local electrical utility. Otherwise, they may be obtained from the National Climatic Center. It is to be noted that cooling degree-day data generally are not considered an effective index of cooling requirements because they do not consider humidity factors the local electrical utility may use some factor other than cooling degree day data (e.g., compressor-run hours). The key concern is consistency. The type of data used for the base year should be used for subsequent years.

•**Building data:** Ideally, one will be able to obtain original building plans and specifications along with "as-built" plans, whether from the building owner/manager or the original consulting engineers or general contractor. If none of these sources can provide what is needed, single line diagrams and supportive data will be required.

•**Operating and maintenance logs, manuals:** Review of operating and maintenance logs and equipment manuals can be useful. These references help indicate how equipment is being operated and maintained and how changes in equipment performance have been dealt with by changes in operating and maintenance control procedures.

•**Utility rate schedules:** Rate schedules should be reviewed to determine if the building is obtaining the best rate or if modifications could result in obtaining a better rate. Utility representatives should be asked to indicate likely future rate changes. For example, will utility policy change with regard to demand metering equipment, thus suggesting the use of equipment which is not dependent on the utility-provided demand meter's end-of-interval pulse? Likewise, are rate schedules likely to be restructured, for example, converting to time-of-day metering or flattened rate approach?

•**Other:** Other information may be available which will assist in the review procedure. For example, in-house personnel may already have initiated certain energy conservation modifications. If so, details should be obtained along with plans for any future modifications. Information should be sought from management on any changes they have planned. Particular importance should be given to any major business re-direction anticipated or physical modifications such as renovation, remodeling, or expansion. Other information needed relates to codes and regulations with which the building and operations must comply, as well as still effective warranties on equipment that may be modified.

Energy Use Is Complicated

As interesting as these data/values are, they tend to obscure the enormous variations among individual buildings in their use of electricity, fossil fuels, and total energy consumption. Available data tend to show that no single variable adequately explains differences in energy use among buildings. Energy use is, as previously stated, a complicated function of many changing factors. This suggests the need for multivariate regression analysis to estimate quantitatively the magnitude and significance of these independent and dependent variables. Some results of such efforts have been published[12] and further efforts in this area are expected. Computer programs for multivariate regression analysis are known to exist and their applications indicate that regression equations developed for public/non-profit buildings show that energy price is the single most important determinant of energy use in these buildings.

Although not simply transferable to commercial buildings, it is clear that detailed information gathered on individual buildings allows engineers and managers to examine, correlate, analyze, and evaluate a variety of relationships. Such analyses of energy use as functions of building location, building type, primary and secondary fuels and their costs, business variations, and weather conditions, etc., simply cannot be done without aggregate data. In addition, adequate data management techniques used are to provide fast and inexpensive ways to check for errors and to fine-tune the techniques themselves if need so indicates.

The results can and should provide benchmarks against which data from individual buildings and previous or similar operations can be validly compared. This should support management by action in hospitality facilities. One must be very careful in the design, analysis, and evaluation of energy management goals and strategies so that energy savings in one area, department, or discipline do not result in increased demand or consumption in another because of improper evaluation and application, thereby causing this operation to become more energy intensive or more energy cost burdensome in the aggregate.

Regardless of whether energy savings are based on illumination of other power drawn reduction and fuel savings, the primary concern must be in compounded results as to energy use *and energy cost* to produce, deliver, and consume the goods and services generated, stored, delivered, and consumed.

It is necessary to understand the very real difference between energy conservation and energy management and, in general, wherever the term energy conservation is utilized, it should be construed to mean and imply the concept of energy management. But, in the end, one should recognize that "it takes energy to manage energy," and one may take comfort in the knowledge that the most effective, uncomplicated, and reliable instrument that is guaranteed to easily cut one's energy bills in half (or by a targeted proportion) is, after all, a pair of sharp scissors.

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[5]Robert E. Aulbach, *Energy Management,* (The Educational Institute of the American Hotel & Motel Association, 1984), pp. 4-5.

[6]Robert Stobaugh and Daniel Yergin, "America and the World," *Foreign Affairs,* 1979, p. 563.

[7]*Total Energy Management,* National Electrical Contractors Association and National Electrical Manufacturers Association, in cooperation with the Federal Energy Administration (Now U.S. Department of Energy), 1979, p. 1.

[9]*Ibid.*

[10]Curt R. Strand, President, Hilton International, reports in the *Hilton International Management Newsletter,* "in the ten-year period from 1975 to 1984, the energy conservation program saved (or more accurately put, avoided) over $30 million — enough money to buy energy for sixty-eight Hilton International Hotels for one year," (November 1984), p. 1.

[11]Modified adaption from *Total Energy Management,* p. 13.

[12]M. Redlin, *Cornell Hotel and Restaurant Administration Quarterly* (February 1979), pp. 48-52, (February 1980), pp. 48-52.