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PLANNING FOR ENERGY CONSERVATION
A COOPERATIVE CITY/UNIVERSITY EFFORT

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Abstract

Cities that are planning energy conservation programs are often in need of assistance in organizing the programs. This paper describes a project which is providing this service to a pilot network of cities. Programs which have been implemented are described.

1. INTRODUCTION

Any person who must pay utility bills either for his residence or place of business is aware of the rapid increase of cost for all forms of energy. This single fact is sufficient to encourage homeowners and businesses to seek means of reducing energy consumption. An additional incentive to many is the awareness of the economic stress placed upon this country by increasing foreign oil imports.

Evidence indicates that most people are making various kinds of attempts to conserve energy. Unfortunately they are often frustrated in these efforts. These frustrations occur for several reasons. Often, in spite of strenuous attempts to reduce consumption, homeowners find themselves confronted with increasing utility bills. They sometimes see utility companies approaching rate commissions requesting rate increases because of loss of income that they attribute to conservation. The public also receives conflicting information from various sources. Often they are exhorted to conserve energy by units of government and yet perceive these units of government to behave as though there were no energy problem. Advertising of energy conservation devices and alternate energy hardware is often confusing, misleading or absolutely false. Many citizens are unable to evaluate the validity of infor-

mation which they receive. The result is often general confusion on the part of the public. The federal government has not improved this situation. The best evidence of this is the fact that over one and one half years have elapsed since President Carter requested energy legislation from the Congress. It is no wonder that many in this country are uncertain that there is an energy problem.

The public has an urgent need for accurate information concerning energy supplies and sources and means of conserving energy. This information must be technically accurate, applicable to the needs of the recipient, and in a form such that it can be implemented by the receiver of the information. In all likelihood the information will be more apt to be implemented if the public has direct access to those who disseminate the information.

The question is who should be the provider of energy information to the general public. There are good arguments that this information should be provided through local government. Although citizens appear to have a general distrust of government at all levels, they appear to be less distrustful of the city government. Programs which occur at the local level are accessible to the public. It is possible to attend

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demonstrations, view exhibits and displays, and discuss individual problems with knowledgeable people in the community. State and federal government programs are, of course, more remote and probably less credible.

2. CITY-SPONSORED ENERGY CONSERVATION PROGRAMS

A number of cities have concluded that locally sponsored energy conservation programs are in the best interest of the public. Delivery of services of this type present a number of problems. One of the greatest of these is that of finding funds for such programs in budgets which often are fixed or decreasing. Cities must determine who is to be responsible for this activity and where the program resides within the structure of local government. The individual charged with development of the program has problems in determining which of the many possible programs are most suitable to the needs of the community. Once this decision has been made he must then determine how best to proceed to implement these programs.

Although many cities have engaged in energy programs of various types there is little specific information available to guide them in establishing programs. Such information as is available is scattered and difficult to locate. Because of this, as in so many other cases, we see communities duplicating efforts as they endeavour to develop programs. A large amount of information of a general nature is available, particularly from the federal government. While this information can indeed be extremely useful, its interpretation and reduction to practice in a specific location is difficult. This is particularly the case in communities that have no one on their staff who has suitable education and experience. Cities need some help in organizing and planning energy conservation programs.

3. THE CITY/UNIVERSITY ENERGY CONSERVATION PROGRAM

Cities that are planning programs of energy conservation often overlook a valuable resource within the community. This resource is the faculty of science and engineering programs of colleges and universities located in or near the community. Members of these faculties possess many specific skills which can be utilized in the development of programs. Those whose specialty is a field of science or engineering are capable of interpreting and adapting information from the technical literature and placing it in a form which can be disseminated to the public. Faculties of other divisions of these institutions can be helpful in developing programs to deliver this information. Under proper circumstances faculty members are often eager

to provide such services to cities. This activity can be equally beneficial to faculty and the communities which they serve. Unfortunately there are impediments to these activities which must be identified and eliminated.

Most universities, particularly those in urban settings, have missions which include teaching, research and scholarly activity, and public service. In most institutions teaching, research and scholarly activities receive most attention. Public service, unfortunately, is often neglected or ignored. When such activities are undertaken they appear to be considered as somewhat less respectable than the traditional teaching and scholarly activity.

Faculty members are also not accustomed to city expectations. Dealing with local government is much different than working with the National Science Foundation or a corporate educational foundation. Cities tend to be solution oriented. They are not interested in research as such, but need answers to specific problems. Usually time is an important factor in these problems and city government does not view extensions with favor. There is also a tendency on the part of some faculty to wish to remain aloof from any hint of engagement in local politics or controversies.

Those in local government tend to view faculty members as thinkers and not doers. Since local energy conservation problems appear (in the view of those who are charged with developing them) to require immediate action, the tendency is to avoid working with university faculty. Because of this cities may use the resources of commercial firms for tasks which are really more suited to the talents and interests of the university faculty. A primary reason for this is that these firms are perceived as being willing and able to provide results within time schedules established by the city.

Both the city and the university faculty can benefit from cooperative efforts. The city gains the services of capable and talented individuals in solving its problems. Also the university often can add credibility to city sponsored programs. The faculty involved will find themselves engaged in some very stimulating work in an environment which is considerably different from that of the campus. There is of course some risk involved, not the least of which is being exposed to the same press scrutiny as are members of the city staff.

The City of Wichita and Wichita State University have encountered the difficulties cited above but have managed, at least in the area of energy programs, to develop a limited but workable relationship. This working relationship was achieved only after participants had worked over a period of several years to achieve it. The salient feature of this relationship is the willingness of both the city and the university participants to engage in a rather open-ended agreement which permits the parties to mutually agree upon specific projects as needs occur.

The Wichita-Wichita State University relationship is being used as a model for the development of energy conservation programs under development in other communities. The purpose of this project, which is supported by Community Service and Continuing Education Title 1-A of the Higher Education Act of 1965 as amended, is two-fold:

- (1) to assist a limited number of cities who are willing to work in cooperation with institutions of higher education in the development of energy conservation programs within their communities
- (2) to develop a process which can be used to disseminate energy conservation and other programs which have been proven successful in one location to other perhaps not similar locations

Nine cities have associated with universities and are participating in this program. These cities are:

- (1) Charleston and Mattoon, Illinois
with Eastern Illinois University, Charleston
- (2) Charleston, South Carolina
with Charleston College
- (3) Fayetteville, Arkansas
with the University of Arkansas
- (4) Fort Collins, Colorado
with Colorado State University
- (5) Garland, Texas
with Texas A&M University, College-Station
- (6) Kansas City, Missouri
with the University of Missouri-Kansas City
- (7) Park Forest South
with Governors State University
- (8) Phoenix, Arizona
with Arizona State University
- (9) Richmond, Kentucky
with Eastern Kentucky University

Projects which have been developed at certain of these communities will be described in a later section.

The following procedure is being used. Participating communities were selected based upon evidence of their willingness to (1) form cooperative relationships with a university to engage in conservation planning and programming, and (2) to commit a reasonable amount of resources to the program. Participating universities were expected to make similar commitments. A two-day workshop was held in Wichita at the beginning of the program. One purpose of this workshop was to allow participants to become acquainted with one another. In some cases, the city and university participants from a particular community had perhaps not met until the initiation of the program. The workshop permitted these people to begin to develop a working relationship without the distraction of other responsibilities which they would encounter at home. The workshop was also used to present programs of the City of Wichita and to permit participants to engage in initial planning. Since the time of the workshop the project staff has maintained contact with each of the groups by means of a newsletter, telephone calls and visits to each community. The staff has provided assistance on specific items as requested by participants. Several case studies of programs are being prepared for dissemination and a Local Energy Office Operations Manual is also available. A second workshop is planned for Spring 1979 at which participants will report upon their activities.

Although participating cities have been engaged in the program for only about six months, several observations can be made.

- (1) Local communities are concerned about energy conservation, both for their own operations and as a means of assisting citizens of the community to conserve energy in their residences and places of business.
- (2) Although energy programs have a high priority in communities there often are more pressing needs which cause delay in development of programs.
- (3) There is diversity of opinion concerning the best way to proceed with programs in specific communities, even though the need for programs may be agreed upon. This results in the slow development of programs.
- (4) University faculty and city personnel can work together in projects of this nature. However, a considerable effort is required on both sides for these cooperative efforts to be successful.

It appears that encouragement from parties external to the community are very helpful in developing these relationships.

- (5) There is and remains an urgent need for a visible, credible information clearing house which may be used by communities who are engaged in energy conservation programs.

4. COMMUNITY CONSERVATION PROGRAMS

Programs engaged upon by communities can be divided into two broad categories: conservation in local governmental operations and conservation in residences and small businesses. Those communities which have directed efforts towards in-house conservation have not abandoned residential programs, but rather feel that these programs will be more readily accepted by the public if the local government has demonstrated its commitment to conservation by developing programs directed toward its own operations. Other communities have adopted the view that the best interest of their citizens is served by providing them first with information which can be applied to their residences, after which conservation in municipal operations will be approached. There is obvious merit in both points of view. The approach taken is dictated by conditions within a specific community. Examples of both approaches are described below.

4.1 RESIDENTIAL CONSERVATION PROJECTS

There are a number of specific residential conservation programs which can be initiated. Several of these are described below. A common element in all of these programs, however, is that of making the public aware of the need to engage in the activity described in the program and providing them with appropriate information so that they may do so. The second element is delivering the service that is the focus of a particular project. Since public awareness and information is central to most residential conservation programs, some observations concerning this activity are given here.

Although it appears to be effective to sell automobiles, refrigerators, food and other consumer items by means of national advertising campaigns, it does not seem to be the case in "selling" energy conservation programs to the public. The public seems to be more receptive to locally generated information than they are to national or state-wide programs. No particular effort has been made to determine the reasons for this phenomenon. One can speculate that the lack of per-

formance on the part of state and federal agencies of government in the areas of energy policy leads the public to disregard information which these units provide. This is unfortunate, because a great deal of the information which is available from, for example, the Department of Energy is useful and has wide applicability. In order that a local public information program be successful the individual charged with operating this program must be careful to establish and maintain the trust of the community. He must appear knowledgeable and unbiased and must be accessible both to the press and electronic media, as well as individual citizens. Often the information which is to be presented to the public exists in the literature. The function of the awareness program, then, is to interpret this literature to the public in such a fashion that citizens are convinced that it is in their interest to apply to information. It is helpful if this activity is supplemented by a modest program of testing and demonstration. This program might well be accomplished by members of the local university faculty. This procedure will give the information additional credibility with the public.

Specific examples of public awareness programs include public speaking engagements, operation of a city test or demonstration facility, preparation and circulation of energy tip pamphlets, operation of an energy fair, and the publication of a column containing energy conservation information in the local newspaper. Each of these programs is intended to bring the activities of the local energy program to the attention of the public and to make them aware of programs which will be of use to them.

Operation of an energy speakers bureau is an effective way to transmit information to various groups in the community, although it is very time-consuming for those running the municipal energy program. Topics covered might range from tips for energy conservation to application of various alternate energy sources and include general discussions of energy supply and demand. Topics covered would of course be governed by the capability of the speakers available. Through this mechanism, the energy program can be described to influential citizen groups.

Another activity which could be categorized as public awareness is the operation of an energy fair. At such an event, booths are set up by a variety of individuals, organizations, and commercial establishments which are related to energy production and energy conservation. Through this means individual citizens can

become acquainted with materials and techniques which may be applied to conserving energy. Some care must be exercised in organizing such an energy fair to assure that no equipment of questionable utility is exhibited. Regardless of disclaimers, the public will tend to believe that equipment displayed at an energy fair is sanctioned by the city.

It is also possible to gain visibility for conservation programs by participating in trade shows and other public interest affairs. Such participation provides an opportunity for the public to have direct contact with the energy staff.

Exposure of energy programs in the mass media is important. Often it is easy to arrange for personnel to appear on radio talk shows and local affairs or other television programs. Energy personnel should expect to be interviewed concerning various energy issues.

A column concerning energy conservation which appears weekly in local newspapers is also useful. In Wichita this column is written by one of the energy staff whose educational background is in mechanical engineering. Readers send in questions about energy matters and the column appears in "Dear Abby" format. Columns have dealt with such topics as insulation, automobile operation and maintenance practices, window coverings--both indoor and outdoor, attic vents, light bulbs, conservation practices for ovens, refrigerators, dishwashers, etc., power saver switches on appliances, infrared heaters, fireplaces, airconditioning practices, and many others.

Other printed matter used in a public awareness program may include the production and distribution of pamphlets containing energy saving tips for heating and cooling. In addition, printed handout materials may be generated addressing specific questions such as ventilation, moisture control, utilization of solar energy, etc.

Every city has access to a residence with construction that is typical for the area. If the energy program can acquire the use of such a residence it can be converted to an energy test and demonstration facility. The purpose of such a facility can be two-fold. First, it can be used simply to demonstrate weatherization of a typical residence. The house can be retrofitted with insulation in the walls, floor and ceiling up to the R-values recommended for the locality. Windows and doors can be weatherstripped. Openings can be caulked. Storm doors and windows can be installed. Other energy saving devices can also be demonstrated

including such items, if applicable, as whole-house fans, attic ventilators, shading type screens and awnings, and the proper use of draperies. The purpose of this facility, then, is to provide a place where the public can obtain objective information about weatherization of their homes. They may obtain information about both materials and techniques of applying these materials. In addition, the energy program may wish to do a limited amount of testing. If this is desirable, it will be necessary to obtain instrumentation and various test objects. Some tests which might be performed is a comparison of effectiveness and cost of various types of heating appliances, comparisons of various small appliances such as ranges, television sets, microwave ovens, etc. A more extensive testing program might include alternate energy sources such as wind and solar. Once again the purpose for performing tests is to add credibility to information which is provided at the facility. The testing program also permits the demonstration of various energy consuming devices.

4.1.1 Specific Programs

Public awareness and information programs must, of course, have some specific focus. There are many of these which might be implemented. One of the problems of those operating a local energy conservation program is to select those projects which will have maximum impact and yet be within the resources of the community. The following are very brief descriptions of a number of programs which have been initiated in various communities:

Weatherization. Many homes, particularly those which are residences of the aged or disadvantaged, are not weather-tight. One program which has immediate effect is that of providing information and assistance concerning weatherization. Included in this type of program would be information about materials and techniques for caulking, weatherstripping, replacing broken glass, and simple methods of providing storm windows. In some locations weatherization clinics have been held at which the use of these materials is demonstrated. Some funds are available, often through the Community Action Agency or the Area Agency for the Aging, to provide materials for weatherizing qualified homes.

Home insulation programs. Addition of attic insulation is one of the most effective means of conserving energy in existing residences. When combined with weatherization steps such as caulking and addition of

storm windows, addition of insulation completes the steps which are practical for most homeowners to improve the energy efficiency of their homes. In some communities homeowners have been given assistance in adding insulation through a system of zero-interest loans. These loans are available to all homeowners but do not apply to rental units. Loans are granted when adequate quantities of insulation are applied by approved contractors. The loan repayment schedule is dependent upon family size and income. A publication describing the City of Wichita zero-interest home insulation loan program is available from the author.

Infrared overflight. One method of pointing out the need for additional attic insulation and other weatherization steps is from the result of an infrared overflight of the community. Infrared images resulting from the overflight give a qualitative indication of the energy efficiency of each structure in the community. These may be used to show owners of structures the need, or perhaps lack of such need, for additional insulation. While very effective, the dissemination of overflight information is quite time-consuming. Experience indicates that 5-15 minutes are required with each homeowner to adequately discuss the performance of his home. This has, however, proved to be one of the most effective ways to provide direct contact with owners of residences and other structures.

Project conserve. This program is a computer assisted home energy audit. Homeowners complete a relatively simple questionnaire which is returned to a central location for processing. A computer program developed by the federal government and made available through state energy offices, is used to process data provided by the homeowner. The resulting analysis, which recommends conservation measures ordered in terms of effectiveness, is returned to the homeowner, often along with some general information about energy conservation. Because of the extreme simplification of information requested on the audit form, the computer results are sometimes misleading. Thus, each audit should be examined before being returned. This is a relatively inexpensive program which provides modest results. A more comprehensive audit program has been developed and is in a testing stage at the present time. There is some question as to whether homeowners will be willing to complete an extensive audit.

Home energy audits. One way to obtain a more accurate audit of residential energy consumption is for the community to provide this service to residents.

These audits are accomplished by teams of two people. After some training and practice each team can audit a typical home in 1 to 1½ hours. A follow-up of audited homes indicates substantial reductions of energy consumption in these audited homes.

Operation button up. This program was designed to motivate homeowners to install insulation and other energy saving devices in order to reduce energy consumption. The program was responsible for circulation of mail inserts through utility bills, development of a lecture kit and speakers bureau, production of several radio and television public service announcements, work with the local newspaper on a special energy edition, development of a fall home tour to feature energy conservation, placement of several articles in regional magazines on the benefits of energy conservation, and creation of a "button-up" kit to enable homeowners to assess their own needs for home energy conservation. A program coordinator served as an information referral specialist in energy-related matters. The project also helped make available low interest loans for the purchase of insulation and enlisted the support of utilities in providing public education services promoting thermal efficiency.

4.2 MUNICIPAL CONSERVATION PROGRAMS

Conservation programs for municipal operations can serve two purposes. The first of these is cost avoidance. Utility and other energy bills for operation of local government have increased drastically in the last 4 years. At the same time local governments are finding it increasingly difficult to find additional funds. In many cases very substantial savings have been effected through relatively simple and inexpensive conservation measures. A second reason for initiating municipal conservation programs is to make residential programs more credible. The public is perhaps more apt to engage in energy conservation if local government has set an appropriate example. The community is then in the position of leading rather than pushing the public to conserve.

Effective city conservation programs have some of the same features as the residential programs. Although the city has more control over the operation of its facilities than over residential facilities, it must nevertheless convince those who occupy and use these facilities that conservation measures are necessary and desirable. Thus most programs contain both an information arm as well as specific conservation projects. The advantage, of course, with city projects

is that much can be accomplished by directive, although information and education is necessary to achieve complete compliance.

The following are examples of municipal conservation projects:

Conservation programs for existing structures. Most communities have a number of structures which house various operations. Often the utility bills for these buildings are substantial. Many cities have established a conservation program for reducing these costs or at least minimizing the effects of rate increases. Specific details of these programs vary, but in general, 4 distinct phases of these programs can be identified. They are as follows:

Phase 1. Inventory of structures operated by the local government in order to become acquainted with the nature of these facilities, the use and occupancy of each facility, and to obtain information concerning energy consumption in each structure. This work is often accompanied or accomplished by a walk-through of the building so that the energy conservationist may make observations.

Phase 2. Once basic data has been accumulated for each structure it is possible to determine and implement conservation measures which require little or no cost. These may include reducing lighting levels, changing thermostat settings, maintenance and minor alterations to HVAC systems, etc.

Phase 3. Planning for implementation of conservation measures that require budget allocations and capital expense is done during this phase. Often funds are available through state or federal grants.

Phase 4. This part consists of implementing retrofits and modifications and monitoring energy conservation results.

Plans examination. Another measure which can be implemented is to assure that new and remodeled structures are energy efficient by requiring that all plans for new and remodeled municipal structures be evaluated by a member of the energy staff. The purpose is to make certain that all feasible conservation measures have been incorporated into the design. These often can be included during new construction or remodeling at only a fraction of the cost of a retrofit.

Employee incentives. Several communities have developed programs which directly involve employees in implementation. While plans vary, the basic scheme is to designate representatives for each structure or, in larger structures, from designated areas, perhaps floors, in the building, who are charged with assuring that conservation measures are implemented. In some instances special recognition is given to those units which have the best conservation record.

Oil, fuels and vehicles. Many communities are now utilizing smaller vehicles, both for the police department and for other more general uses. In some cases smaller equipment has also been added to the fire department fleet. These vehicles are smaller and more maneuverable than previously available and are used to respond to minor emergencies, using less fuel than the larger equipment.

Other programs associated with the use of vehicles include oil and fuel conservation programs. One such program provides for oil from vehicles to be collected after use and sold to a private contractor for reprocessing. Another program involves collecting oil samples from vehicles on a regular basis for analysis, which enables personnel to change oil according to lubricating properties rather than for fixed time intervals. Equipment can be monitored so that periodic reports on fuel and oil usage of individual vehicles can be collected. Decision for replacement of vehicles is in part determined by these reports.

Paper recycling. In this test program, used white paper which would otherwise be discarded is collected and sold to a local recycling company. Preliminary evaluation of this program indicates that cost of collecting and transporting the paper is only slightly less than the resale value of the paper.

5. SUMMARY AND CONCLUSIONS

The City/University energy conservation project has been in operation for less than 1 year, but has had measurable effect in each of the communities. Products of the project to date include a monthly newsletter, a manual to guide the establishment of local energy programs, and case studies of specific projects. Information concerning these items is available from the author.

An evaluation of the work to date leads to the following observations:

- (1) Most communities are concerned with energy conservation and are quite interested in

establishing a program. Very often lack of information on how to proceed impedes the implementation of such programs.

- (2) Development of programs is often slow. Most communities do not have the resources required for rapid implementation of programs.
- (3) The development of city/university cooperation is variable and as one might expect dependent upon the commitment of individuals involved.
- (4) Programs develop individual characteristics although many are transported from one location to another.
- (5) Conservation programs will result in substantial cost avoidance, both to homeowners and to city governments.

6. BIOGRAPHY

A. Richard Graham is Professor and Chairman of the Department of Mechanical Engineering at Wichita State University. He has Degrees in Mechanical Engineering from Kansas State University and the University of Iowa. Dr. Graham has served on the faculties of Kansas State University, the University of Missouri-Rolla and the University of Iowa.

Dr. Graham's current research interest is in the utilization and conservation of energy in buildings including the application of solar energy. He is currently engaged as a consultant to the City of Wichita Energy Office, and is the Director of a City/University Conservation Project sponsored by the U.S. Office of Education. In addition he operates a small solar testing facility on the WSU Campus.