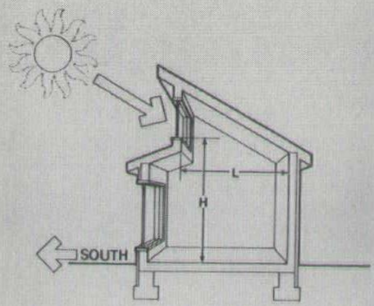
new mexico architecture

July—August 1981 $1.00

Solar—an Energy Source
—fourth in a Series—



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The House on the cover:

Much debate has appeared in the press recently about the so-called "double envelope house," which is based on the principle of a convective loop between two building "envelopes." The debate centers around the question of whether the convective flows really transport meaningful amounts of heat to mass storage or whether double envelopes are simply super-insulated houses with an enveloping layer of warmed air acting as the source for most of the perimeter heat losses. The debate goes on.

The house pictured on the cover is NOT a double envelope. It is a wholly different type of passive heating system, but one which relies totally on air convection for the transport and storage of heat. This house, located northwest of Santa Fe, is one of 8 airsiphon buildings designed and built by Mark M. Jones, AIA, in the Santa Fe area since 1977, with design and collaboration of researchers W. Scott Morris, B. T. Rogers, and Bruce Hunn. These systems, utilizing simple site-built flat plate collectors placed below floor level, allow air to rise as it is warmed by the collector (to 150°F) and flow through ducts from the collector outlet to rockbeds inside the house—without fans. Solar savings fractions have been monitored in the range of 80 - 97%.

(Cover: Passive Airsiphon House NW of Santa Fe,
Mark M. Jones, AIA, Architect)

—Official Publication of the New Mexico Society of Architects, A.I.A.—

International Standard Serial Number—0545-3151

THE AIA URGES REAGAN ADMINISTRATION TO SAVE FEDERAL ENERGY CONSERVATION PROGRAMS

WASHINGTON, D.C., July 16, 1981—The president of The American Institute of Architects has told the Reagan Administration that federal energy conservation programs must continue funding research for improving energy efficiency of buildings and also continue to disseminate information on buildings and energy use to the design profession and building industry.

Alexandria (Va.) architect R. Randall Vosbeck, FAIA, presented the AIA's views during the Environmental Protection Agency's public hearing on new directions of federal energy conservation programs. He noted that current directions are guided by two general principles: higher energy prices will "speed up" conservation efforts; and the private sector will be able to "pick up" activities previously carried out by the federal government.

The head of the 36,000-member national professional society described how two existing federal programs—research and information—"are beginning to experience the real impact of the new federal directions."

Since 1973, he noted, client demand for energy-efficient buildings has increased not only because of higher prices, but also as a result of "better and more widely available information." Most of this information is a "direct result of the federal energy conservation program," he added.

"This information flow has speeded up innovation in the building industry: design manuals, seminars and computer programs provide tangible design solutions for designers willing to try new buildings," Vosbeck explained.

Expressing concern that this information flow "is about to be cut off," he told the EPA panel that "the fragmented building industry" cannot take over extremely technical research reports and turn them into design manuals nor reduce large-scale computer programs into simulation programs for hand-held calculators.

"The new direction calls for a more basic research and development approach for the building sector," Vosbeck pointed out. "The stroke of a budget-cutting pencil has eliminated projects that have potential to help our industry solve its short- and mid-term problems and has instead substituted research of a long-term nature.

"The building industry, however, will not be able to pick up the integrated research at the national level that was characterized by much of 'federal buildings' research," the AIA president stressed. "These activities do more than provide performance data; they spawn design tools that belong to the public domain."

On the new directions' spending priorities, Vosbeck said: "We question the efficiency of allocating remaining resources to high-risk projects—especially when so many short-term problems need just a little additional work for market acceptance." He suggested that the AIA assist the government during this period of transition in deciding how to spend remaining funds.

Unless federal energy conservation programs are continued, Vosbeck predicted that the "potential to reduce energy consumption by 40 percent by the year 2000 will be missed." And architects' efforts "to design and retrofit buildings for even greater energy efficiency will be impeded by the lack of new research knowledge."

MEMORIAL SYMPOSIUM FOR BRAINBRIDGE BUNTING SCHEDULED

An architectural history symposium in memory of Brainbridge Bunting has been scheduled for November at the University of New Mexico. A distinguished panel of speakers has agreed to appear: J. B. Jackson, Santa Fe; David Gebhard, University of California at Santa Barbara; David Van Zanten, Northwestern University; Neil Levine, Harvard; Sharon Irish, graduate student, Northwestern University and Christopher Wilson, graduate student, University of New Mexico. The symposium is scheduled for Friday, November 20 from 3:00 to 5:00 pm and will continue on Saturday, November 21 from 9:00 am to 1:00 pm in room 2018 in the Fine Arts Center at the University of New Mexico.

For more information contact Professor Christopher Mead, Art Department, UNM Albuquerque, N.M. 87131.

BOOK REVIEW

SOCORRO, A Historic Survey, by John P. Conron
University of New Mexico Press, $12.95. Reviewed by Fern Lyon

Our very own fearless, peerless editor has written this architectural history of Socorro, starting with the early 1800s. As you know, John is an architect who strayed into the uncertain and perilous paths of historic preservation. He waxes enthusiastic about preserving old buildings and old towns, and some of us old folks might do well to see what he can do for us.

In addition to its local interest, SOCORRO can serve as a guide book for other towns trying to make intelligent decisions about preserving their own historic sites and buildings. The appendixes consist of recommendations for Socorro that could well serve as a pattern—a model ordinance for "Historic Districts and Cultural Properties. . ."; a sample of *Form A* from New Mexico State Register of Cultural Properties; criteria for evaluating architectural changes in sites already registered; guidelines for rehabilitation of old buildings; and a list of addresses where you can get additional information.

All of this is written in a readable style and laid out so that it is easy to use. *F.L.*

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BUILDING ENERGY CODES
by William L. Burns, AIA

New Mexico Architects are familiar with the existing prescriptive energy code that currently applies to all in-state projects. Chapter 53 of the Uniform Building Code is a modification of the ASHRAE 90-75 developed by the American Society of Heating, Refrigerating and Air Conditioning Engineers. There is, however, a new federal regulation in the making that is planned to replace the present energy codes. The code is being developed by the Department of Energy and is commonly referred to as BEPS (Building Energy Performance Standards).

Architects and building Owners alike can not be happy with the prospect of another building code, especially the BEPS which requires sophisticated computer runs to prove compliance. But the energy codes seem necessary because of the existing barriers and general reluctance to accept conservation. The obvious barriers are as follows:

1. Cheap Fossil Fuels: Even though current fuel costs have tripled and future fuel is expected to inflate up to 20% annually, the fuel costs are still cheap when compared to alternative energy sources.

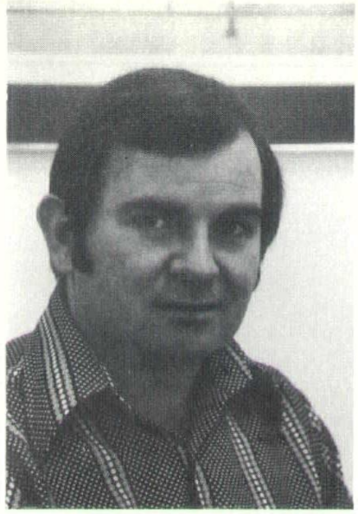
2. Commercial Tax Laws: Many features of the tax laws promote cheap, energy-wasting systems. Energy saving devices require an upfront capital investment that must be depreciated over the equipment's life, whereas operating expenses are totally deductible in the year incurred.

3. Increased Initial Cost: Financial institutions make loans based upon costs of initial construction and operation costs of historical building systems. Therefore, an Owner cannot obtain mortgage money for energy saving devices and must either buy the equipment out of his own pocket or pay the penalty for increased operation costs. Even if the Owner includes energy saving devices, the mortgage company will probably not credit the reduced operating expense to increase the building's loan value.

4. Rental/Speculation Building: Speculators who construct buildings for immediate resale will always attempt to minimize the intial cost of the building, and will not make any energy saving investment which would add even minimally to that first cost. Because today's Owners of rental property exclude most operating expenses from their lease, the building Owner is not motivated to include any energy saving system that will require more capital investment.

AMERICAN AUTOMOBILE INDUSTRY

The American Automobile Industry is a good illustration of the results of ignoring the Owner's demands for increased energy conservation. Before the federal government established fuel consumption requirements, our automobile manufacturers were not providing the fuel efficient automobiles the consumers were demanding. In fact the automobile manufacturers fought the adoption of the conservation standards citing that the standards were too restrictive and



William L. Burns, AIA

William L. Burns, AIA, a partner of The Burns/Peters Group, has a Bachelor of Fine Arts with a major in Architecture from the University of New Mexico. Mr. Burns is currently serving as an advisor to the National AIA Energy Notebook and is a member of the following energy conservation organizations; National AIA Energy Committee, International Solar Energy Society, New Mexico Solar Energy Society, and New Mexico Solar Energy Task Force. In addition, Mr. Burns was the 1980 President of Albuquerque Chapter of the American Institute of Architects and is a Director of the New Mexico Society of Architects. He is also a member of Construction Specifications Institute and a Director of the Albuquerque Chapter.

that the cost of changing systems was too costly. Because our manufacturers were reluctant to change, the consumers quickly found that foreign manufacturers offered them a wide range of fuel efficient transportation. These cars performed the same function as the American made cars, but were smaller, lighter and had very efficient engines and therefore cost much less to operate. *(We are all watching the auto industries belated efforts towards providing energy, and cost, efficient automobiles. Editor.)*

Hopefully, Architects and Engineers will not make the mistakes of the American Automobile Industry. We should be more flexible than a manufacturer of a mass produced automobile and be able to accommodate energy conserving features within our buildings.

BUILDING ENERGY PERFORMANCE STANDARDS (BEPS)

The Energy Conservation and Production Act of 1976, Public Law 94-385, mandated the development of energy performance standards for the design of new buildings by 1980. Standards are to be performance oriented, rather than prescriptive. The objective is to not restrict the art of building conscious design, but to accommodate the development of technology and design innovation. This system is similar to the U.S. Department of Transportation's requirement to set fuel consumption targets for new cars. The standards are to encourage maximum practicable improvements in energy efficiency and increased use of non-depletable energy resources. Specifically, the standards are to be applied at the design stage of each building, before its construction; they are to take the form of energy budgets, putting a ceiling, for example, on consumption of BTU's per square foot per year, based upon a particular climate and building type. The standards are to reflect the energy consumption of a building as estimated from the design using an accepted set of assumptions about building occupancy and operation. The particular State, and not the U.S. Government, must certify that buildings meet BEPS.

The Department of energy has issued a "Notice of Proposed Rulemaking" for Energy Performance Standards for New Buildings, dated November 1979. Copies of the code can be obtained from the DOE Albuquerque Operations Office. In addition to establishing the energy budget for each area and building type, the code gives acceptable evaluation techniques to prove that buildings meet the code's requirements. Basically, these evaluation techniques consists of three public domain computer programs (DOE-2, TRANSYS and DEROB) and climate data for 78 cities. The estimated predicted results are supposed to be within +/− 15% of a building's actual energy consumption.

The proposed edition of BEPS uses weighted factors for fossil fuels in commercial application's natural gas is 1; oil is 1.20, and electricity is 3.08. The designer first calculates the energy requirements by fuel type, expressed in MBTU/sq. ft./yr., and then multiplies by the weighting factors for each fuel type. The total sum of these factors is the Energy Budget Level. For Albuquerque, the allowable Energy Budget Level, expressed in MBTU/sq. ft./yr., is as follows: (1) Hospital = 353, (2) Nursing Home = 164, (3) Small Office = 104, (4) Elementary School = 96, (5) Shopping Center = 185. Interestingly energy supplied by solar energy systems is not included in the Energy Budget Level, therefore a building design may use as much solar energy as desired. This should be another incentive for solar energy.

So that the Architect can be sure that his building design meets BEPS during the initial design stages, he can usually rely upon easier and simpler programs that can be run on the popular minicomputers. The Princeton Energy Group is one such company developing these programs. These programs can be a great aid to the Architect during the design stages without the expense involved in a full DOE-2 computer run. But the DOE-2, TRNSYS or DEROB will be required after the construction documents are complete, as proof that the building conforms to BEPS.

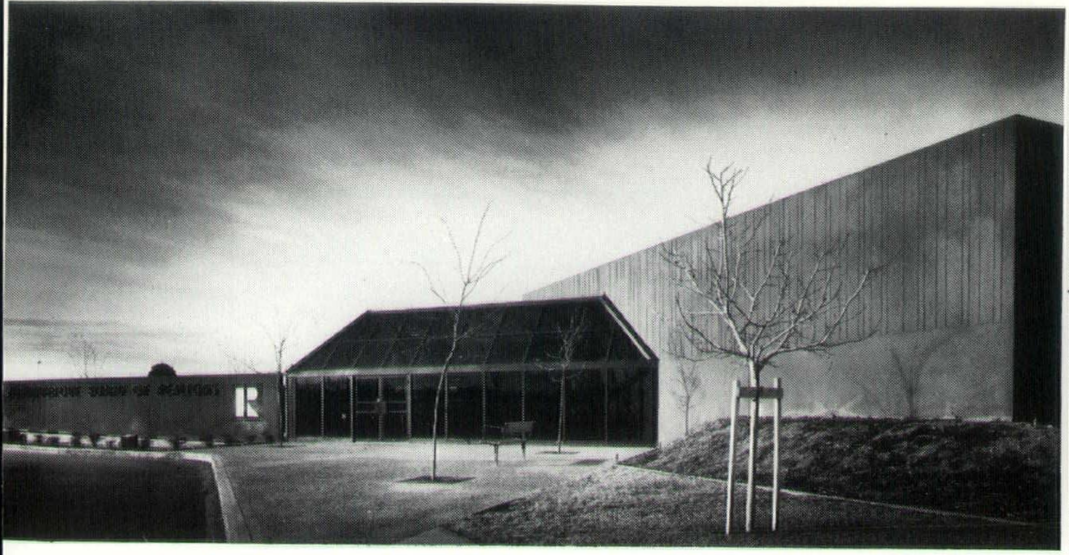
The BEPS as published has run into a great deal of opposition, and some of it is justified because all of the "bugs" have not been worked out. Of instance, any project within New Mexico has its energy budget established as if the project were located in Albuquerque, because no other areas are given for the State even though our climate varies greatly. Also, the fuel weighted factors are controversial and incomplete since LPG is not considered.

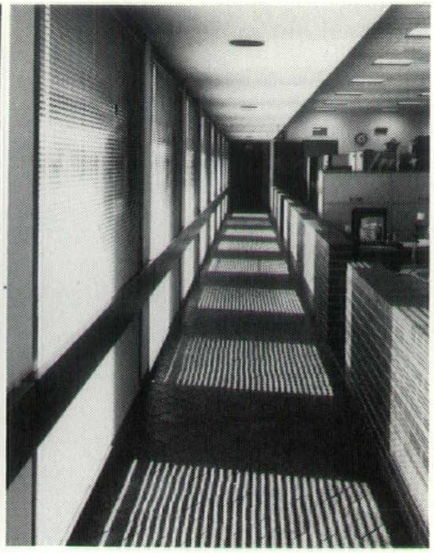
By far the biggest complaint is the anticipated cost of proving compliance with BEPS. DOE-2 is a very complicated computer program that is currently only available for CDC 7600 systems. It has been estimated to take an average of one-man week just to program the machine for a small project without a complicated mechanical system. Also there are some that doubt DOE-2 abilities to accurately measure energy consumption. DOE-2 has not been widely tested in real building applications, but the results of the computer model are suppose to be within 15% of a building's actual performance.

THE AMERICAN INSTITUTE OF ARCHITECTS

The American Institute of Architects has recognized the Architect's responsibility to create energy efficient buildings. In 1972 the AIA appointed a task force to explore the relationships between energy and the built environment and to determine how the design professions can contribute to solving the nation's energy problem. In 1975 the AIA adopted the task force's report titled "A Nation of Energy Efficient Buildings by 1990". This report outlines a national program to achieve the potentials of energy efficient buildings. It projects energy savings of 30% for retrofitting old buildings and 60% for new buildings initially designed to be energy efficient. The report shows how the program can be made economically, financially and administratively feasible, and presents a series of recommendations for immediate action.

The American Institute of Architects lobbied for Public Law 94-385 and has continued to support the development of the law into the present Department of Energy (DOE) design standards called Building Energy Performance Standards (BEPS). In fact, the AIA Research Corporation (AIA/RC) contracted to DOE to provide 168 different projects, located throughout the United States, that are specifically designed for energy conservation. These energy conscious designs are for actual existing buildings constructed in 1975 and 1976 which represent the first generation of buildings designed after the 1973 oil embargo. The energy conscious re-design was subcontracted by AIA/RC to the original Architect and Design Teams. The Burns/Peters Groups was one of the firms selected for this program. Our project was the redesign of the Southwestern Electrical Building, Albuquerque. The building program requirements were only modified to include energy-conscious redesign that represented the current state-of-the-art, not the leading edge of technology. The project original site and functional program was retained. The Design Teams attended workshops and preliminary and final design reviews sponsored by AIA/RC. The results of this effort was the production of comparative sets of energy performance data for the original building and the energy conscious re-design. The figures reveal that including energy consciousness into the design process can lead to an average savings of a 40% reduction in energy. *W.L.B.*



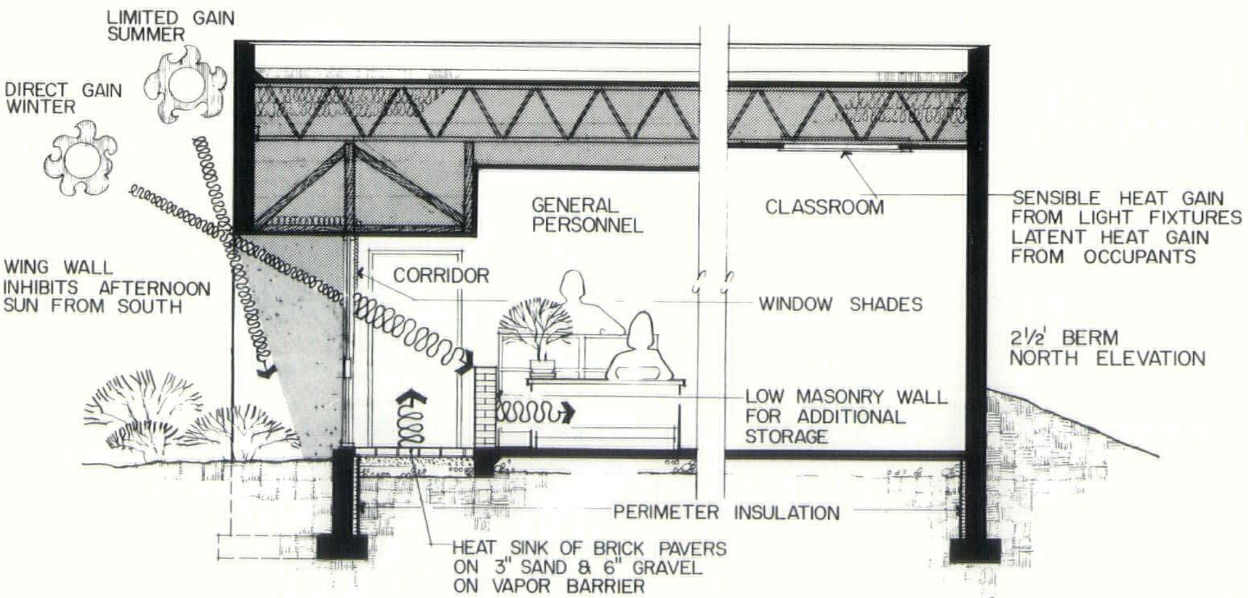


OFFICE BUILDING FOR ALBUQUERQUE BOARD OF REALTORS

The offices of the Board of Realtors, were seen as an excellent opportunity to demonstrate the potentials of passive solar design that could be applied to residential design at little additional cost above conventional construction.

The building is organized with the most heavily used spaces on the south exposure. The storage and service rooms are in the central zone, and the classrooms are along the north side with direct exterior access. The classrooms receive a substantial portion of their heating from the occupants. Combined with the need for no natural light, because of heavy usage of audio-visual equipment, their location in the area of least solar advantage is desireable. To help reduce heat loss, the north side is bermed to a height of 2½ feet. The building's basic square shape has a very favorable relationship between area and exposed surface.

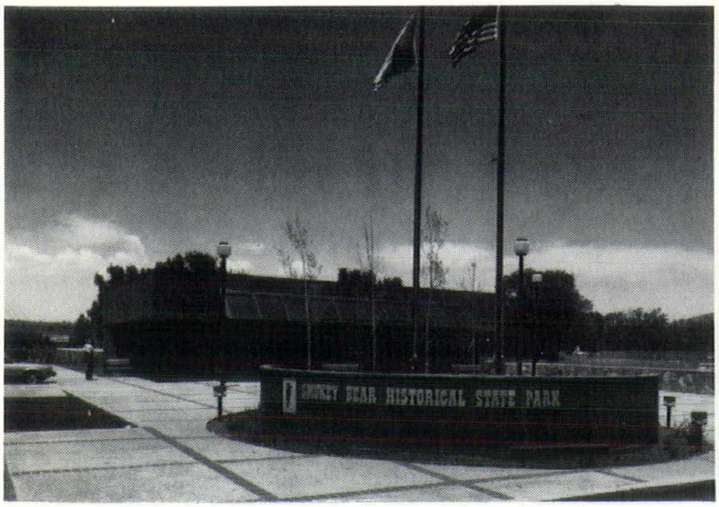
The passive solar application on the south side consist of a glazed gallery/corridor. The space recieves direct solar gain in the winter and stores the energy in the adjoining low masonry wall, and in the floor which consists of brick pavers over a 3" sand bed, which is over a 6" gravel fill. This heat is then rediated back into the space at night and on cloudy days. The glazed wall has fins oriented to the southeast to block out the late afternoon summer sun. A three foot overhang blocks mid-day summer sun, but allows for a penetration deep into the building in the winter. The estimated pay back time for the system is 8 to 10 years.

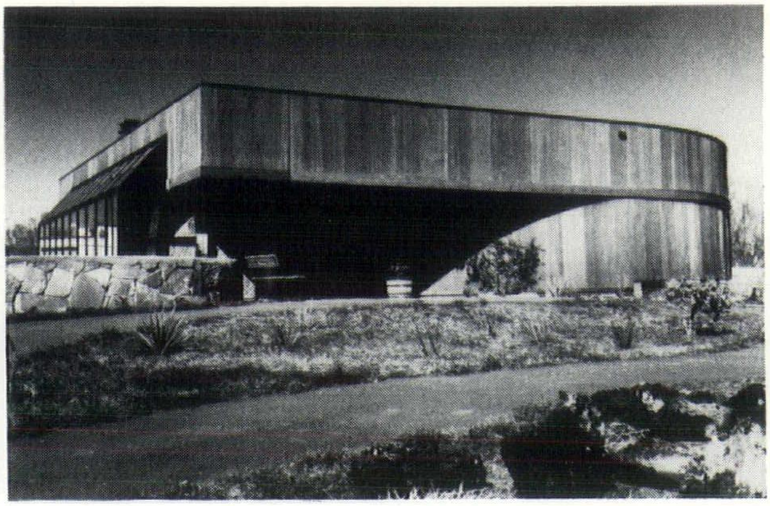


SECTION SHOWING PASSIVE SOLAR SYSTEM

wner: Albuquerque Board of Realtors
rchitects: KRUGER LAKE HUTCHINSON BROWN
eneral Contractor: SeeGee Engineering Co., Inc.
onstruction: Wood frame

Area: 9,110 square feet.
Mechanical System: Gas fired roof top combination heating and cooling units.





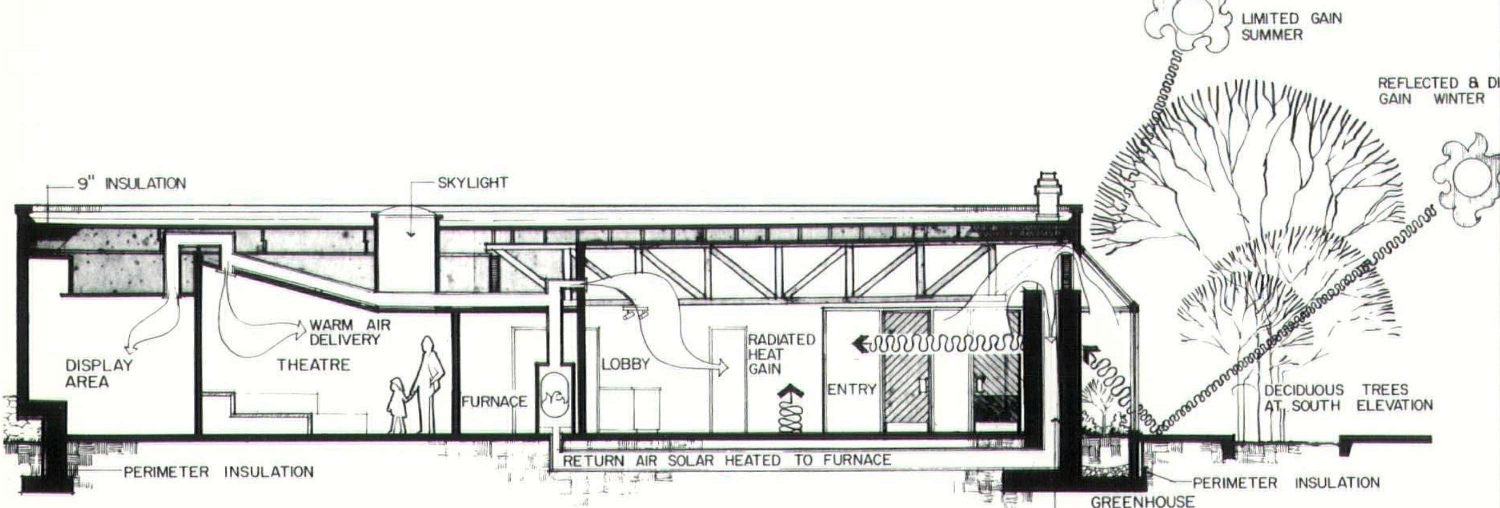
SMOKEY BEAR HISTORICAL STATE PARK, CAPITAN, N.M.

For nearly a quarter of a century, Smokey Bear has been the living symbol of the National Forest Fire Prevention campaign, and it was deemed appropriate to honor this unique bear and what he represents with a museum in Capitan. It was the desire of the state of New Mexico to use this project as a demonstration of the belief that in this day, energy conservation is of the same necessity that forest conservation was 25 years ago.

The structure is organized with the windowless exhibit and support spaces on the north side of the structure. The north portion of the building is semi-circular, thus reducing the perimeter exposure to the minimum. The entry lobby is placed to the south facing the paved plaza and street. This arrangement makes the building an obvious candidate for passive solar design.

To this end the lobby is enclosed to the south with a solar greenhouse and is paved with a 4" exposed aggregate concrete floor. In addition, there is a large free standing fireplace and stone columns directly behind the glazed wall. These act together to create a heat sink, and allows the lobby to serve as a solar collector for the entire building. The mini blinds on the interior of the greenhouse provide a control system for the collector. The sun can be directed onto the floor slab in the mornings, and due to the slab's lower mass, solar gain can be taken advantage of sooner. In the afternoon, the blinds can be adjusted to shade the floor, but to allow for the columns and fireplace to continue to receive direct gain. Due to the larger stone masses' greater heat lag, they do not present the same threat of overheating from continued solar exposure as does the floor.

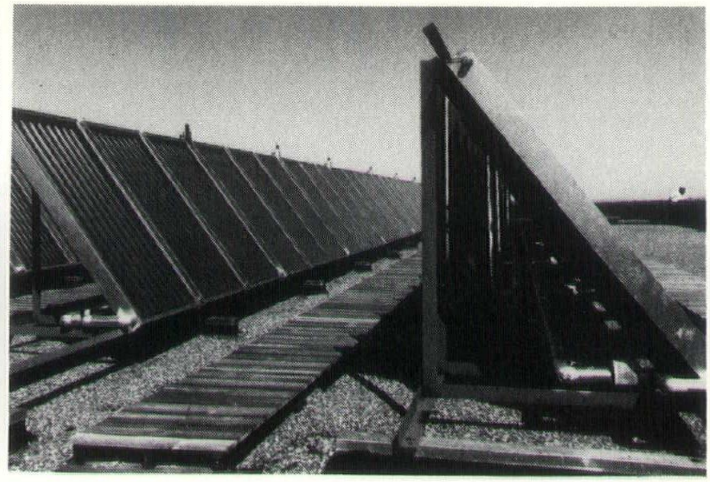
The mechanical system further reinforces this natural system, by the location of the forced air system return registers for the entire building at ceiling level on the south side of the lobby. This arrangement provides for pre-heating the return air before the entering of the furnace. During the summer months, the greenhouse is protected from overheating by decidious trees located immediately in front of it. The energy usage for the building has been cut to approximately 55-65% that of a conventionally heated building.



SECTION SHOWING ACTIVE & PASSIVE SYSTEMS

Owner: State of New Mexico, Natural Resources Department & State Parks and Recreation Division
Owners Representative: Bob Findling, Planner Director of the State Park Planning Division
Architect: KRUGER LAKE HUTCHINSON BROWN
General Contractor: Gerald A. Martin, Ltd.

Construction: Wood frame
Area: 3,211 sq. ft.
Mechanical System: Gas fired forced air updraft and wood burning fireplace
Cost (building only): $258,400
(including site work): $290,750



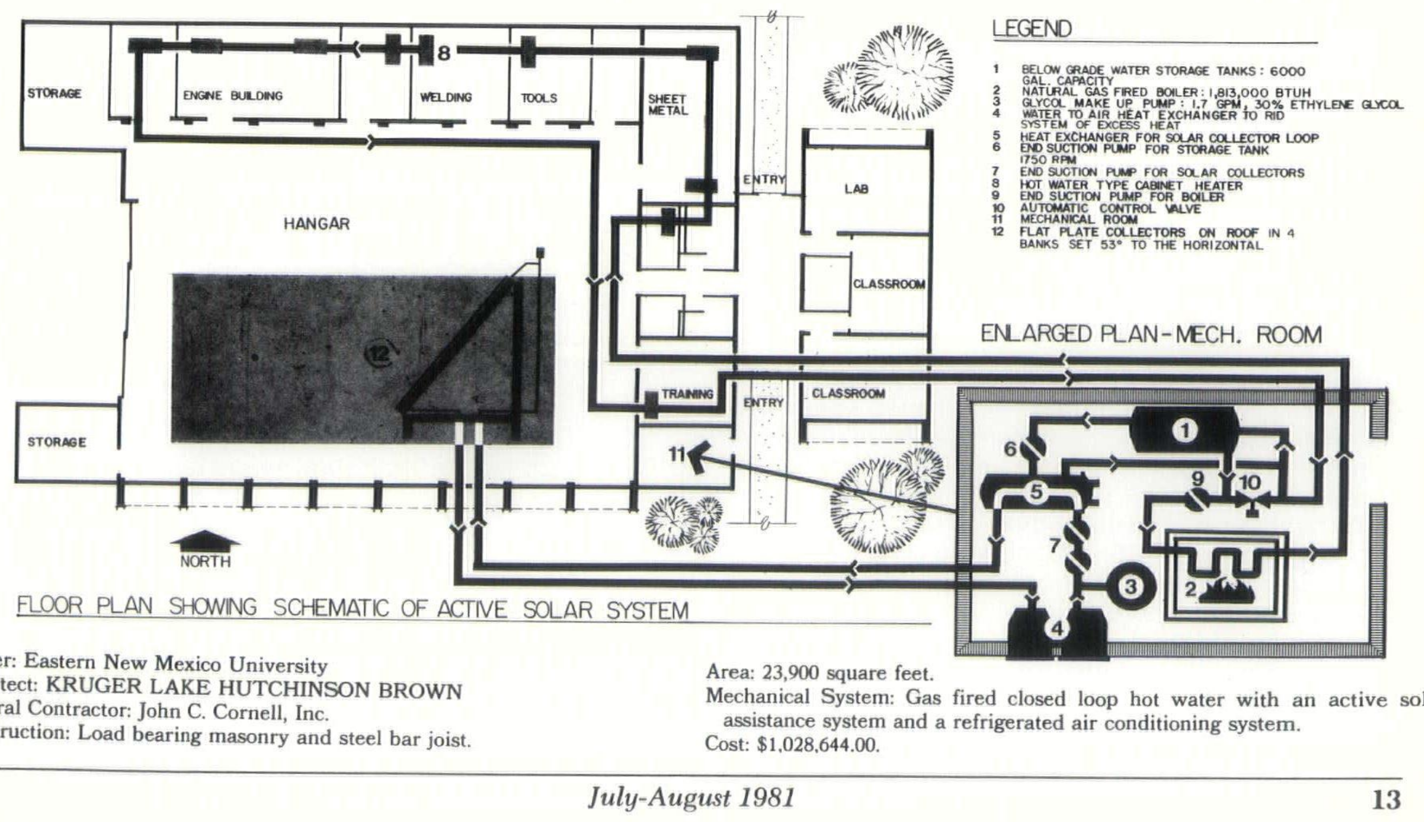
AIRFRAME & POWER MECHANICS BUILDING, ROSWELL N.M.

'his structure, designed as an educational facility to train airplane mechanics is unique in its combination of occupancies. There are conventional classroom paces, workshops, and a high bay airplane hangar. Each of these has its own distinctly different comfort requirements.

ɜeyond these requirements, were the desires to use a system that could adapt to changes in future energy sources, and be energy efficient with the currently vailable fuels. After completing the State's mandated energy analysis for the proposed facility, it was determined that an active solar assisted heating system vould be feasible. The system selected is a hybrid active solar and gas fired recirculating hot water cabinet heater system. it will allow for conversion to other nergy sources with minor equipment replacement. The need for circulating air in the classroom spaces was satisfied by an air handling system with a heat exhange between the hot water system.

'he solar system utilizes fixed collectors that use an ethylene glycol and water mixture in a closed loop. A heat exchanger makes the transfer of energy between ıe two closed loop systems, after the solar system has reached a required differential in temperatures. At times of excess solar gain, two 3,000 gallon water torage tanks store heated water to be rcirculated at night and on cloudy days. The system has a projected energy savings of 70% when compared to a convenonal system.

ı addition to the active system, passive energy conservation was incorporated into the design. Due to the mild winters and hot summers, heating was not seen as ıe area that could benefit most from passive contribution, but rather cooling and lighting were. The windows of the hangar are protected by both deep hotizontal nd vertical fins. The large windows are thus protected from direct gain in the summer, but combined with the north windows allow for cross ventilation, as well s significant daylighting. All hangar light fixtures are of the H.I.D. type to further minimize the usage of energy.



FLOOR PLAN SHOWING SCHEMATIC OF ACTIVE SOLAR SYSTEM

wner: Eastern New Mexico University
rchitect: KRUGER LAKE HUTCHINSON BROWN
eneral Contractor: John C. Cornell, Inc.
onstruction: Load bearing masonry and steel bar joist.

Area: 23,900 square feet.
Mechanical System: Gas fired closed loop hot water with an active solar assistance system and a refrigerated air conditioning system.
Cost: $1,028,644.00.

ENERGY AUDITS & ENERGY MANAGEMENT

by Larry W. Bickle, Ph.D., P.E.

Larry W. Bickle, Ph.D., P.E.

Dr. Bickle is president of the Bickle Group, A Division of The CRS Group, Inc. In addition to his administrative duties, Dr. Bickle frequently participates in key technical projects.

Major energy consulation and mechanical design projects include the Burns/Peter Office Building. (Honorable mention, Owens Corning Awards 1979), Mazatlan Branch Office for Bancen (Federal Reserve Bank of Mexico), Raffles Tower (650,000 sf speculative office building in Singapore), Solar Villas (one of the largest active solar HUD demonstration projects) and the ICC Headquarters Building in Seoul, Korea. These design projects included State-of-the-Art solar and energy conservation strategies, Energy Management and Control Systems and conventional mechanical, electrical and plumbing design services, The architectural clients for these services include I. M. Pei, John Portman and Associates, HOK and CRS, Inc.

Dr. Bickle was one of five national experts selected by the U. S. Department of Energy to review the 42 national passive solar commercial demonstration projects. As a result of his experience with this project, he is currently writing a Passive Solar Design Handbook in cooperation with the U. S. Solar Energy Research Institute.

Introduction

Energy conservation is a popular subject. So popular, in fact, that the federal government, under President Carter, appropriated some $900 million to conduct energy conservation programs in public schools and hospitals. Energy audits play a major role in this and other federal programs: but, so much attention has been given to energy audits, that they have become almost synonymous with energy management. This is a dangerous trend. Energy audits do not in themselves produce energy savings. They are simply one of several essential steps in an energy management program.

Energy audits do have a useful role and should be conducted. This paper, however, takes a critical look at energy audits. The goal is to raise important issues and limitations for both owners and auditors to consider. Hopefully, this will allow more effective use of energy audits within the framework of a meaningful energy management program.

Types of Energy Audits

There are a wide range of activities that are loosely described as "energy audits." At one end of the scale, simply collecting utility bills, calculating energy consumption per square foot, and comparing this consumption to "normal" or "average" values might be termed an audit. At the other end of the scale, a professional engineer and/or architect's audit might include spending several man-days inspecting a building, testing HVAC equipment, measuring lighting levels, computing theoretical performance, determining life-cycle costs, and preparing retrofit construction documents.

The exact level or type of energy audit is not pertinent to the issues raised in this paper. In general, however, most of the points relate to audits in which a professional makes site visits and performs technical calculations. In the terms used in various federal programs, this would be a "Class A" type audit and would include some aspects of the Technical Assistance Program (TAP) type of technical and economic calculations.

Limitations of Energy Audits

With this general background, consider the following:

A. *Energy audits do not save money by themselves.* It costs money to conduct any kind of an energy audit. Unless the findings of the audit *are used*, the audit itself will produce no savings. Conducting an audit before there is top level management commitment to implement the results can be a serious waste of money.

B. *It is possible to do an energy audit too early in the program.* If a detailed energy audit is conducted too early in the overall energy management process, there is possibility for misdirection. Many of the most important first steps in the energy management program, such as changes in administrative policies, cannot be easily quantified. Unfortunately, neither the true cost nor the energy savings from these actions can be put into a mathematical relationship. However, there is evidence which suggests that these actions may have benefit/cost ratios of 50 to 100 times greater than capital improvements.

While most energy audits do identify low and no-cost actions, the energy audit with its calculations and "precise" numbers for capital improvements can focus attention away from these more important early action areas. The net result may save energy but not be the most cost-effective program.

C. *There are significant limitations in the engineering techniques used to compute energy consumption in buildings.*

1. Engineering analysis techniques to analyze the long-term average impact of "small" actions are not readily available. For example, it is not possible to accurately estimate the yearly savings that would result from replacing a specific piece of weatherstripping or from installation of edge seals on outside air dampers.

   But, many of these so-called "minor" capital improvements can, when taken collectively, produce substantial energy savings. But, these "minor" actions also involve considerable cost, and thus, it is important not to apply them indiscriminately in every case. In technical terms, the result of each action is smaller than the uncertainties in the calculation techniques themselves.
2. Even if there were not uncertainites in engineering techniques themselves, there would be uncertainties in the input data. The input data which is difficult to obtain in precise terms includes a description of the building, the environmental variables (such as temperature, wind, and solar radiation), and internal loads (such as occupants and lights).

   In an older building there are usually uncertainties about wall insulation, control system set points, *in situ* efficiencies, and other "details." Even when this is not the case, reducing a real physical building to a set of idealized nodes, conductances, and terms in a calculational model introduces simplifications and loss of precision.

   Shade trees, obstructions at ground level, local ground reflectants, small lakes, etc., change the specific micro-climate for an individual building. In most cases, engineering calculations will use macro-climate information from nearby weather stations. The result is uncertainties and lack of precision in the weather data specifically applicable to the building being studied.

   How many people are in the building at the same time? What hours is it operating? Are exhaust fans switched off at certain times? Do occupants turn off lights when they leave the room? How are draperies used? All of these and other important questions about the interaction between occupants and the building affect the precision of the energy consumption calculations. These occupant use patterns are extremely difficult to determine with any precision because they change from hour to hour, day to day, month to month, and year to year.

   Assumptions add to assumptions and so on. Even the most complex, comprehensive computerized methodologies such as DOE-2, BLAST, TRACE, and AXCESS can rarely predict actual energy consumption in a building to within 10 to 15 percent. Discrepancies of 25 to 50 percent between theoretical calculations and actual consumption are not uncommon. An occasional difference of 100% or greater is not unknown. How much of these differences are due to calculational techniques and how much are due to errors and lack of precision and input data is not clear. What is clear is that the overall precision of the process is not much better than the total combined savings of possible modifications.
3. Another engineering problem is that few simplified methodologies exist for predicting the interaction between energy conservation modifications. Simply put, energy conservation modifications are not cumulative; two modifications that each would save 10% probably would not save a total of 20% if both were implemented. In the simplest case, the first modification saves 10% and the second saves 10% of the remaining 90% or 9%.

   But the situation can be worse: both modifications could compete to save the same energy. Consider, for example, the combination of double-glazing and a night setback thermostat. Both modifications reduce heat conduction through the windows, but the interaction is highly complex. If the night setback temperature is 55 F and the nighttime outside air temperature is 55 F, there is no temperature difference to cause a heat flow. Thus, the double-glazing has zero added benefits at that particular instant. Clearly the savings of making both of these modifications is not the sum of the savings that would be calculated for each modification individually.

   These complex interactions can be modeled to some extent using sophisticated computer simulation programs such as DOE-2. However, there need to be simpler ways to evaluate the interactions between potential modifications.

D. *Another major limitation of energy audits is cost estimating.* Most of the standard cost extimating methods and data files are designed for use with either new construction or major remodeling. Mush of the energy conservation retrofit work is really "odd jobs" that are handled by small independent contractors. These costs tend to be highly localized and difficult to predict. While no single retrofit project is large, there can be a large percentage error in cost estimating. These cost estimating errors can accumulate to produce large errors in the total project cost.

Energy Managment Program

In spite of the limitations raised in this paper, energy audits do have an important role to play in an overall energy management program. The energy management program needs to focus on more basic issues.

Exactly what is "basic" varies from one client to another. Based on our own past experience, and a review of available literature, we would propose the following as building blocks for a successful energy management program. Whether you agree or not, an internal discussion of these fundamental issues will help focus energy management efforts for maximum results:

A. *Energy conservation should be viewed as an upper level management responsibility.* Energy conservation involves improved operations and maintenance and investments in hardware. These are but pieces of the broader management problem of controlling energy costs. A well-balanced program will cut across internal divisions and require policy changes, integrated adminstrative practices, improved operations and maintenance practices, public relations programs, and finally, capital investments.

B. *An energy conservation program should be financially sound.* Energy conservation actions cost money. Weigh these costs carefully against potential savings so only cost-effective actions are taken. The definition of "cost-effective" must be formulated at the policy level using opinions from as many interested parties as possible.

Administrative and policy changes tend to be least costly to implement, are the most cost-effective and should be undertaken first. Improvements in operations should be undertaken next. And capital improvements should be deferred until last.

By progressing from less expensive changes to funding the more expensive improvements out of proven future savings, a client can have a "self-financing" program.

C. *Establish goals and priorities.* State precisely the goals of the energy conservation program. Is it to reduce costs? Improve public image? What are the relative priorities of the various goals? In so far as possible, these goals should be quantitative.

D. *Energy conservation is a team activity.* Whatever program evolves must be a cooperative program between all participants. Recognize that energy management is a sensitive activity. The program defined for a particular client must be unique and responsive to local needs, conditions, personalities, requirements, restraints, and the broader goals of the client's organization.

E. *Focused accountability and responsibility are critically important.* While energy conservation is a team activity, one person must be in charge. This person must provide clear, strong leadership. The energy management program must be well defined and specific responsibilities and authority agreed upon by all participants.

F. *Motivation and evaluation of progress are vitally important.* Energy conservation is really a collection of many small actions, like turning out the light when leaving an unoccupied room. Motivation and constant feedback are essential to a cost-effective energy conservation program.

One of the best ways to both motivate and provide feedback is to implement an effective, easily understood, and highly visible "scoring system" for measuring the success of the energy management program.

An added benefit of this scoring system is that energy conservation actions—policy changes or capital investments—can be evaluated and quantitative estimates of actual savings made.

G. *Energy conservation programs are site specific.* They must be tailored to specific climatological conditions and building types.

H. *A Master Plan for Energy Management (MPEM) should be developed.* This plan should identify specific responsibilities, establish evaluation criteria, and systematically rank actions into logical priorities for implementation.

Clearly these "basics" are not absolute, but they do illustrate how the commonsense management techniques of commitment, motivation, education, and evaluation can be integrated into a meaningful program to reduce energy costs. Perhaps more importantly, implementation of an effective energy management program provides the proper perspective for interpretation and use of energy audit results. *L.W.B.*

ANNOUNCING A NEW LATE AFTERNOON & EVENING GRADUATE PROGRAM—MASTER OF COMMUNITY & REGIONAL PLANNING

The School of Architecture and Planning proudly offers a course of studies leading to a Master of Community and Regional Planning (CRP) degree. This course of studies shall now be offered in the late afternoon and evening, thereby opening up opportunities for students whose family, or work schedules do not permit attendance during the regularly scheduled class day. This schedule is designed to serve the particular needs of the part-time student, whose interest is in pursuing a professional graduate degree.

Courses will be offered each semester applicable to the degree. Students will be admitted to the program through formal application to the University and to the School of Architecture and Planning. It is expected that the student could complete the course of study within a five-year period.

What is this degree all about? The Master of Community and Regional Planning (MCRP) is a 42 unit professional program. In general, a person holding an MCRP degree would find employment in private and public organizations which are concerned with land use, natural resource and human resource issues. For example, the State of New Mexico employs over two hundred and fifty people with titles involving planning; and almost all cities over 20,000 have a planning staff. Much of the planning practice involves developing solutions to complex physical, social and resource questions and the ability to analyze problems as a general model of practice. Planning in an applied sense involves providing answers to questions that have distinct spatial and locational meaning.

During the course of study, a variety of issues facing the Southwest will be addressed. These issues include: land development, natural resources, energy and water conservation, managed or directed growth and the rural nature of the southwest. The southwest as a region provides the focus and backdrop for the general educational motif of the program. This fall we offer the following late afternoon and evening courses, which may be of interest to you:

Monday 5:30-8:30 p.m.—*Social Planning* (3 credits), taught by J. Rivera.

Tuesday 6:30-9:15 p.m.—*Seminar in Energy Administration* (3 credits), taught by M. Hamilton

Tuesday-Thursday, 4:00-5:15 p.m.—*Planning Theory & Process* (3 credits), taught by W. Siembieda

Wednesday 6:30-8:30 p.m.—*Neighborhood Planning* (2 credits), taught by L. Columbo

All of these courses are for graduate credit. You may enroll for up to 6 hours of credit as a non-degree student with the consent of the instructor.

For more information and the Bulletin of the Program in Community and Regional Planning, call or write Ms Rhita Jaques at The School of Architecture and Planning, University of New Mexico, Albuquerque, New Mexico 87131 (telephone 505/277-3133).

With the growth of the southwest, issues related to community and regional planning will be at the forefront of the major concerns facing this region's citizens. The demand for professionals trained in the field is growing, and the need for people trained with a particular view towards the Southwest is evident in all of our everyday lives.

A SENATE MOYNIHAN "RESOLUTION"

The following resolution, introduced in the Senate of the United States by Daniel Patrick

continued on page 18

continued from page 17

Moynihan (D-N.Y.), should be of intrest to all concerned with the built environment!

Resolved,

Whereas in the Fall of 1980 the frame of the new Senate Office Building was covered with plastic sheathing in order that construction might continue during the winter months; and

Whereas the plastic cover has now been removed revealing, as feared, a building whose banality is exceeded only by its expense and

Whereas even in a democracy there are things it is as well the people do not know about their government;

Therefore be it Resolved that it is the sense of the Senate that the plastic cover be put back.

From Blueprints, Summer 1981 published by the National Building Museum, Washington, D. C.

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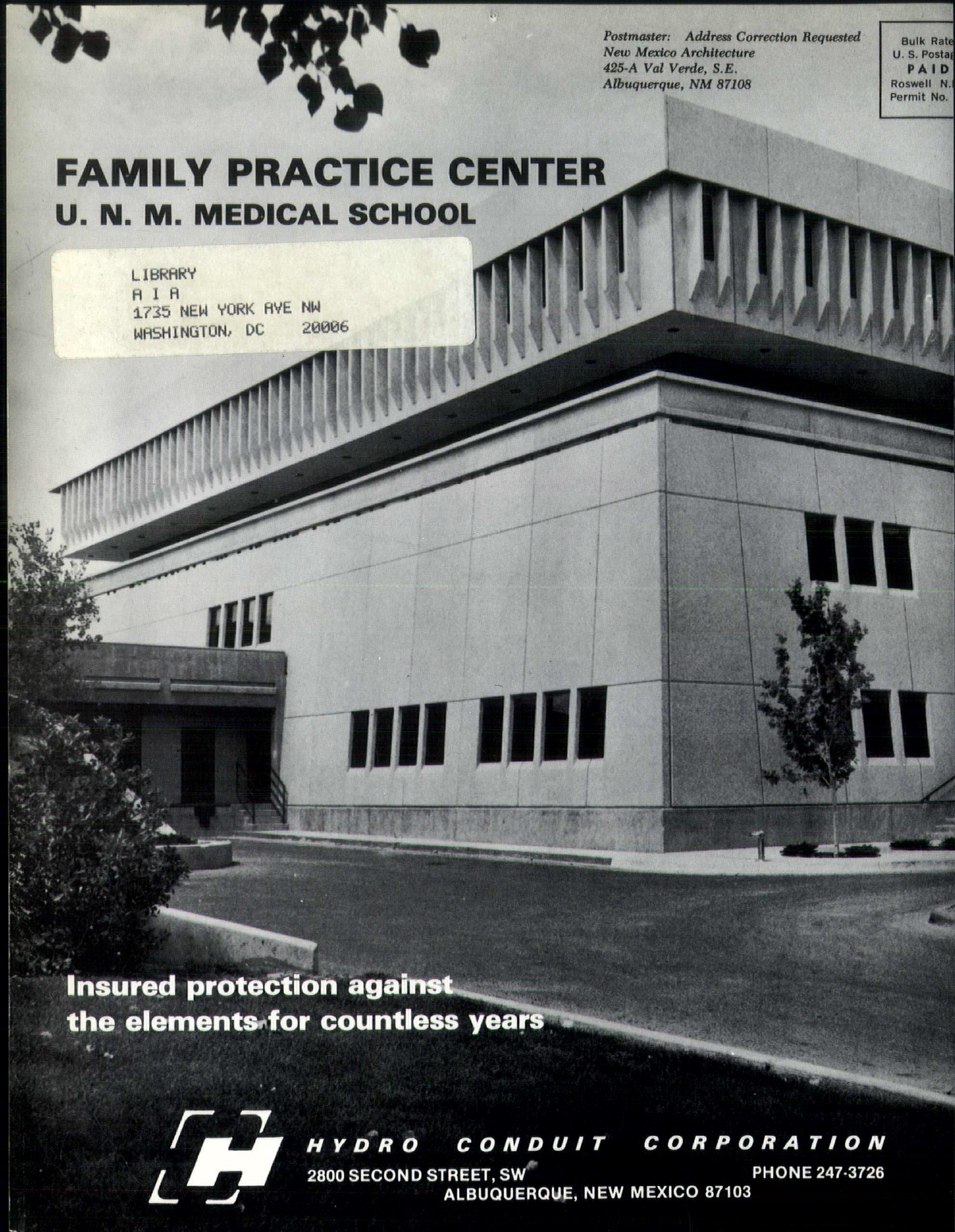

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