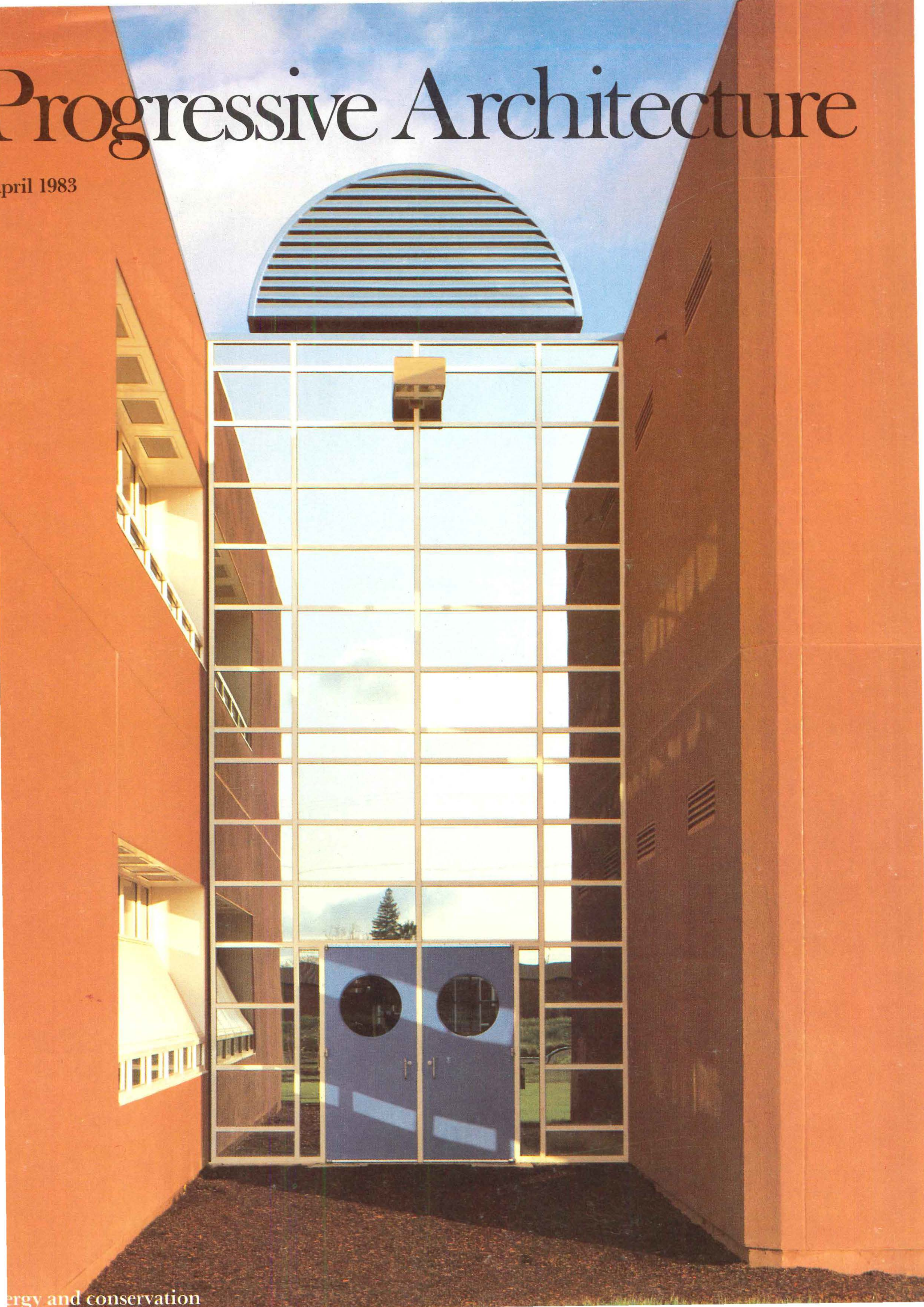
Progressive Architecture

pril 1983



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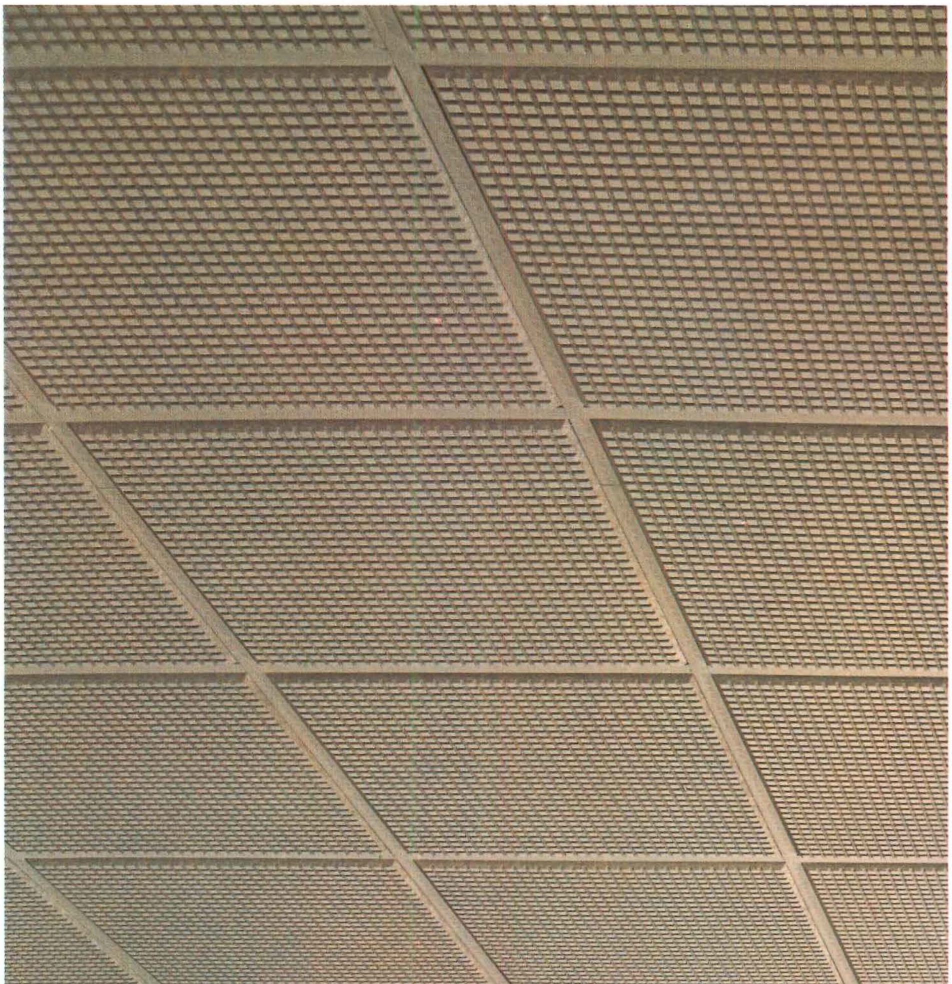

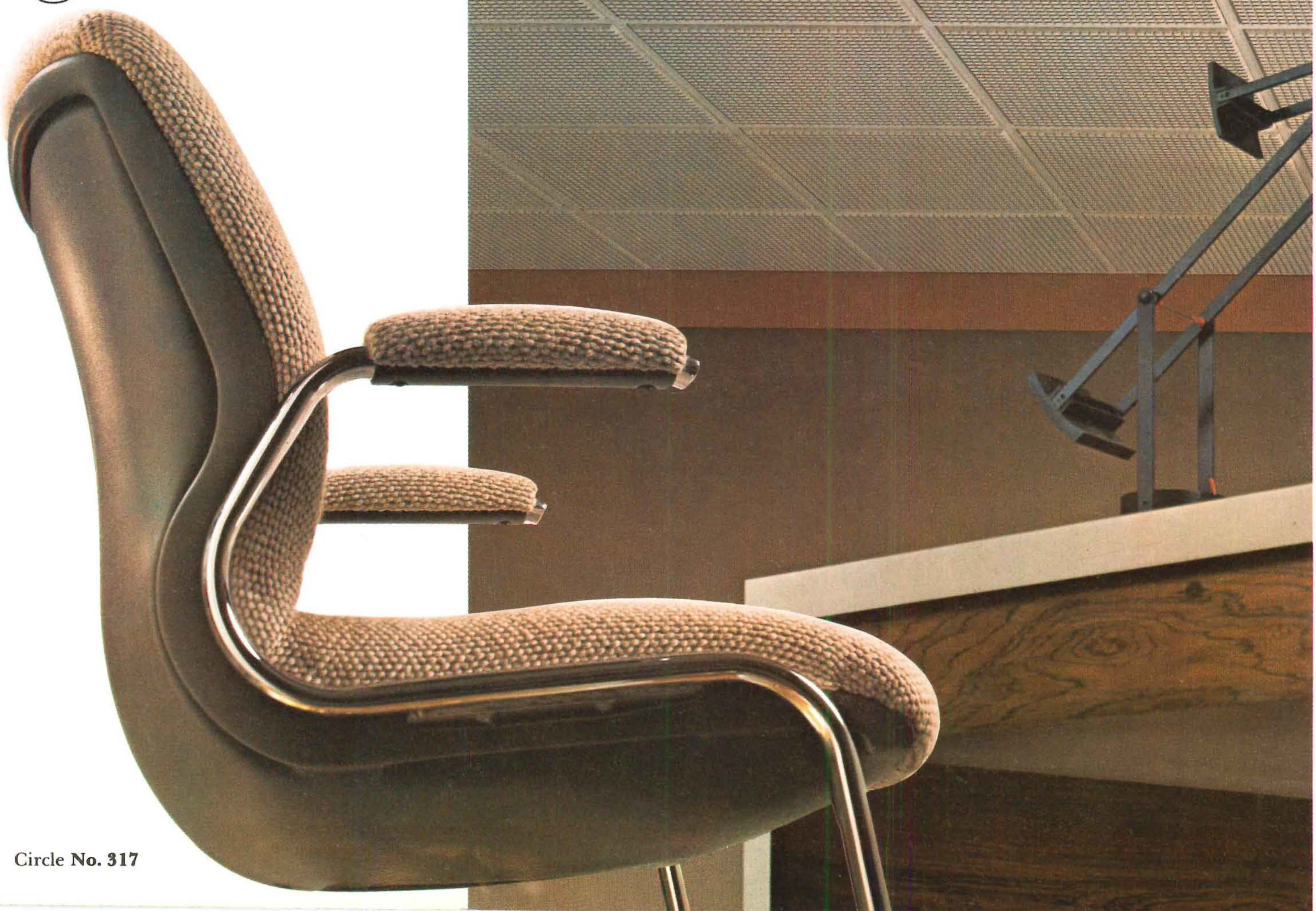

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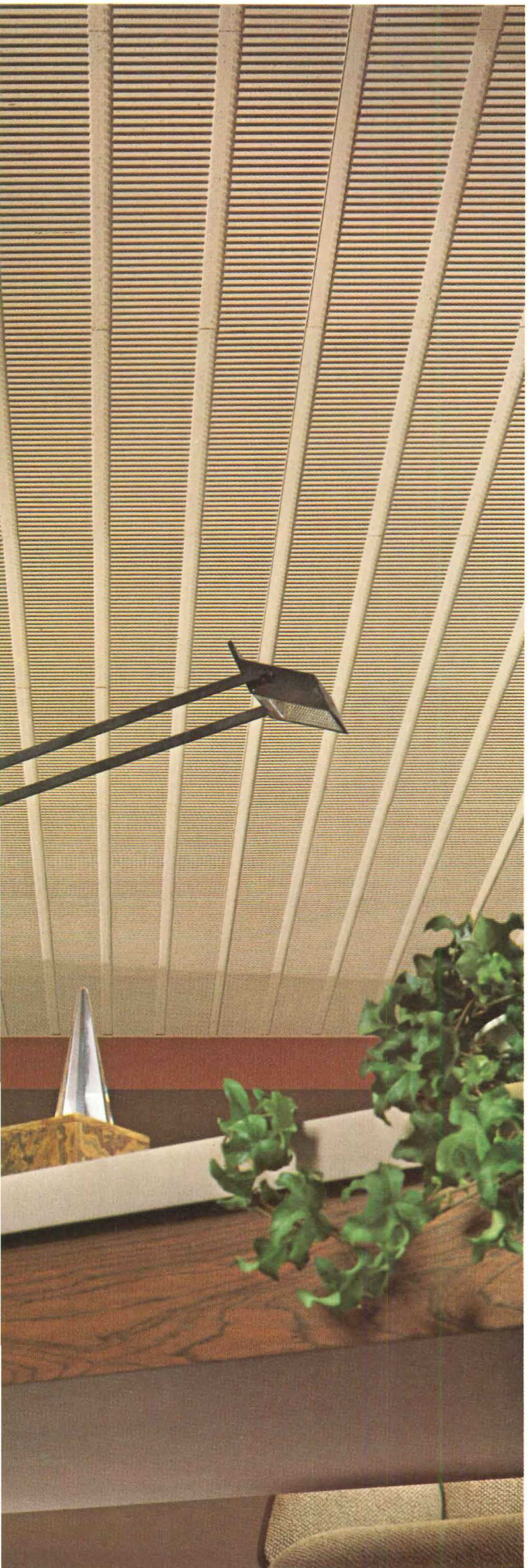


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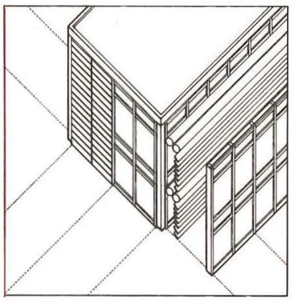

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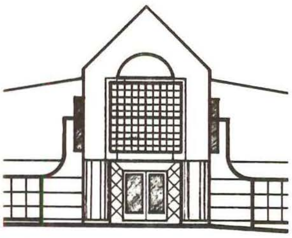

94

116

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Progressive Architecture (ISSN 0033-0752) published monthly by Reinhold Publishing, Division of Penton/IPC: Philip H. Hubbard, Jr. President; Harry I. Martin, James J. Hoverma Robert J. Osborn, Vice-Presidents; Penton/IPC Thomas L. Dempsey, Chairman; Sal F. Marin President; N.N. Goodman, Jr., Benjamin Hummel, Paul Rolnick, Executive Vic Presidents.

Executive and editorial offices, 600 Summ St., P.O. Box 1361, Stamford, CT 06904 (20 348-7531).

Subscription information:
Send all subscription orders, payments, ar changes of address to Progressive Architectur P.O. Box 95759, Cleveland, OH 44101 (216-69 7000). When filing change of address, give form as well as new address and zip codes, and incluc recent address label if possible. Allow two mont for change. Publisher reserves right to refuse u qualified subscriptions. Professionals include a chitectural and architectural-engineering fir personnel and architects, designers, engineer and draftsmen employed in allied fields.

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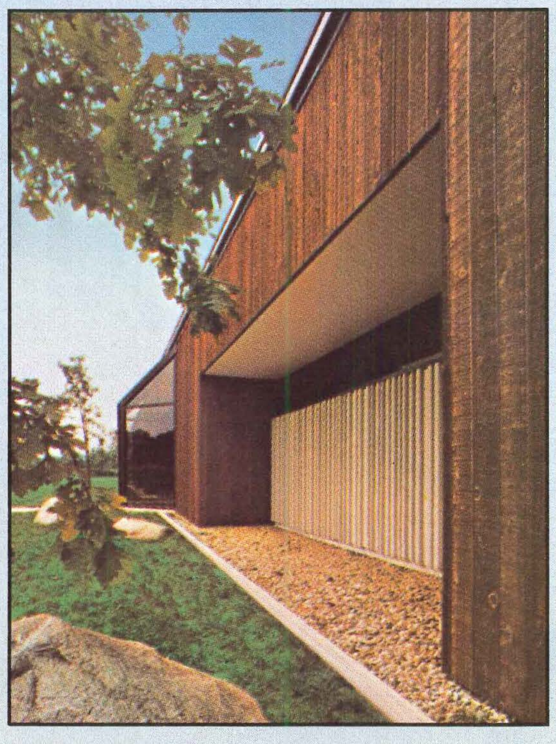

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Mr. Alan Parker
President
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Ann Arbor

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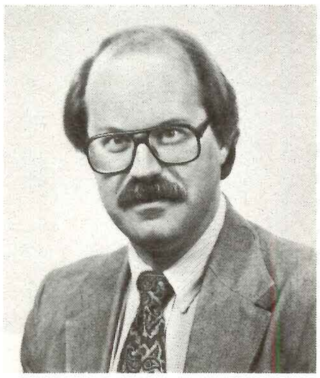
Mr. Michael McKelvey
Architect
Ann Arbor



"This is one of the most successful steel buildings I've seen. Without sacrificing function, we were free to concentrate on appearance and to depart considerably from people's conception of what a steel building is, or used to be. We chose attractive cedar and pre-cast concrete as exterior materials. Actually, almost anything can be used. But there are several other major advantages. The sure predictability of scheduling and cost is very satisfying. Also, steel buildings like this one afford matchless interior flexibility and allow for future expansion. It'll be relatively simple to move an exterior wall back 80′ and still use it as an exterior wall."

Mr. Edward Klusowski
Senior Vice President
Michigan National Bank
of Detroit
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"We feel very secure investing in a steel building of this type. We particularly like its flexibility of interior usage. Its durability and low cost of maintenance are also quite attractive to us. And, steel buildings of this design offer broad adaptability for long-term owners to future tenants' differing needs—without excessive conversion costs."

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Environmental dilemmas

onservation of resources nd environmental quality ose many conflicting hoices for society in eneral and the architecture rofession in particular.

"Hungry? Out of work? Eat an environmentalist." So reads the bumper sticker ahead of me on I-95.

What makes so many solid citizens blame our current economic ills on environmentalists? There are more obvious sources of our economic disturbance: staggering changes in the cost of our energy, the drop in our birth rate, shifts in demands of our jobs market, tougher competition among industrialized nations. Many other, more debatable factors have been blamed: short-sighted business management, insufficient growth of productivity, economic burdens of bureaucracy, economic burdens of armaments, abandonment of much of our urban fabric.

Of course it costs a lot to process sewage, to control smoke emissions, to hold up permits for costly nuclear power plants, to dispose of dangerous chemical wastes safely. But isn't the health and safety of the population in general one of the most obvious responsibilities of government? Even if we were to rescind all recent environmental regulations, our underlying body of law demands restitution from the producer of hazards. The situation of the asbestos industry and the recall of cars, foods, and drugs make this clear.

Whatever the fundamentals of environmental law and ethics, we now have an administration dedicated to questioning all regulations and easing the burdens they impose on free enterprise. As we worked on this issue, a series of events riveted public attention on simmering environmental problems. Midwinter floods unleashed deadly amounts of dioxin on the little community of Times Beach, Mo., and the reality of a town that had to be evacuated spotlighted the workings of our Environmental Protection Agency. Congressional and press inquiries soon led to allegations of delayed enforcement, political motivations, and favoritism toward industries. Questions were raised about the effectiveness and morale of government offices undergoing sharp cutbacks in budget and staff. (Compare the Dept. of Energy situation, P/A, April 1982, pp. 106–109.)

The resignation of environmental administrator Anne Burford has by no means suppressed investigative zeal among members of both parties in Congress, the press, and environmental groups. President Reagan has maintained that "environmental extremists" are a threat to be resisted, but he hasn't defined extremism in this area.

Ironically, the environmental awakening of 10–20 years ago is only now being felt in new regulations at the local and state level. In Connecticut we began returning our bottles and cans a couple of years ago. This year the state started a program of testing automobile emissions—a reasonable public concern where we probably have the nation's highest density of idling cars per acre; the law has been attacked as invading an area of private responsibility, but it is being enforced. (My 1976 station wagon passed easily, so the rules aren't unduly tough.)

We in architecture generally followed the public's and 1970's shift away from broad environmental concerns toward the more urgent matter of energy conservation. We have been comfortable in the knowledge that burning less fossil fuel helps improve air quality, but we know that alternative heat sources—coal, nuclear fission, even wood—can raise serious environmental problems.

We are also aware that energy-saving and environmental quality don't always go nicely hand-in-hand. One of the first and most effective strategies for saving energy in buildings is to reduce infiltration and turnover interior air generally; but buildings, occupants, and equipment emit a staggering variety of gases, germs, and some detectable radioactivity, much of which used to get wafted away through ventilation systems. Some of the materials and techniques architects and interior designers depend on most may be hazardous within tighter building envelopes. Ventilation requirements, drawn up decades ago in the name of public health, are quite properly being reconsidered, but we're going to have to find out more. Even that energy-conscious single-family house, with the wood stove and the superinsulation, may present health hazards we haven't yet measured.

Architects have an obligation to learn all they can about the impact of design decisions on the environment around their buildings and the occupants inside. Some of the articles in this issue will help to explain what is now known. Architects also have an obligation to press for government support of basic building research, which this administration has virtually eliminated (P/A, March 1983, p. 25). The profession must do everything in its power to see that public policies—and the decisions architects make for their clients—promote long-term health and safety vs. short-term economic payoff.

John Morris Dixon

Views

Stage set and props?

The renovation of the Kramer Residence by architects Machado-Silvetti, P/A December 1982, poses important questions regarding the production of Interior Architecture which were not covered by your review of the work.

Where I can appreciate the (rhetorical) development of the architectural floor plan and elevations, it is the lack of an architectural section that betrays this project. Instead of a permanent architecture, we have props (columns, pilasters, lintels, etc.); that is to say, a stage set. Without any consideration to the reflected ceiling plan, what could have been a truly successful project (realism) is transferred to theater (surrealism). Every light and lamp in the living room and dining room is lit, including the candelabra. How haunting!

This sensation of surrealism—altered permanence—is also evident on the rooftop terraces with the "correction principle" at its best. One only has to look at the false fireplace, the crystal ball, the table with no chairs, and the bottle of wine with four empty glasses to realize that the correction principle is equated with surrealism.

If this project is to advance any serious thought then its first step to a permanent architecture will be by returning the colorful robe seen throughout residence to the *Sleeping Gypsy* of Monsieur Rousseau.

Joseph P. Martinez, AIA
President
Martinez/Wong & Associates, Inc.
San Diego, Calif.

[Sure it looks temporary; it's an apartment interior. And much of the surrealism is conscious. But we don't see what is so "haunting" about turning on all the lights; would photographer's floods alone have lent it a reassuring homogeneity? Lack of a ceiling plan—actually a ceiling plan that is virtually blank—has been quite common in Modern Architecture; hardly remarkable. The robe, though it keeps reappearing in the *article,* remains in one spot in the apartment.—Editors]

Professional Underwriters identified

A recent It's the Law column (Jan. 1983 P/A, p. 162) referred to a lawsuit in Michigan: Lehr vs. Professional Underwriters. That lawsuit was instituted in 1938 and involved a firm with no connection whatsoever to Professional Underwriters, Inc., of Southfield, Mich., and three other locations. Founded in 1968, this firm now insures over 500 architectural and engineering firms in 28 states.

Credit due

A name was inadvertently left out of th credits for the Pendleton Junior Hig School (Feb. 1983, p. 120); Clerk-o the-works was David Butts, who als designed, specified, and supervised th installation of all sports facilities, lanc scaping, and furnishings contracts.

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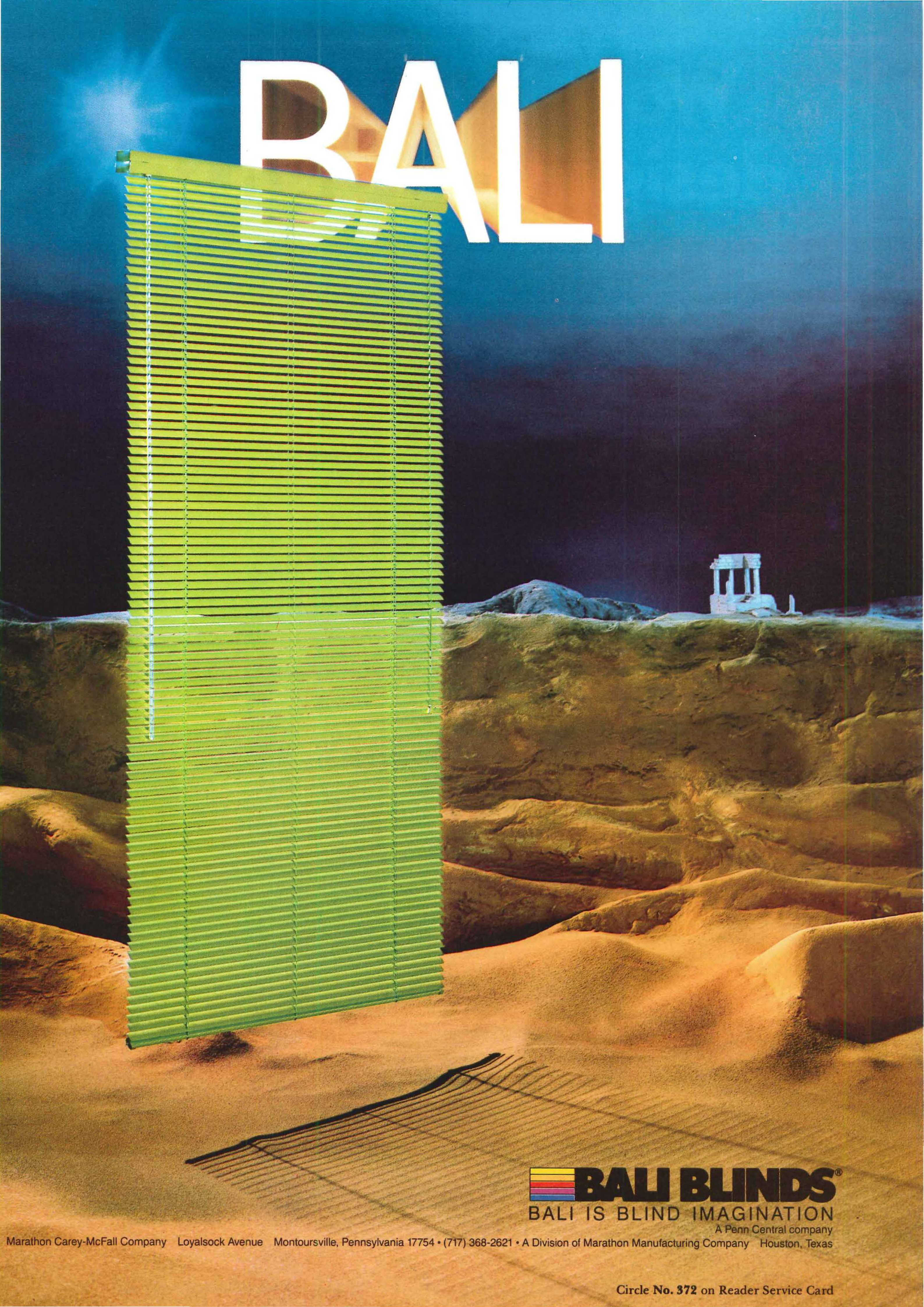
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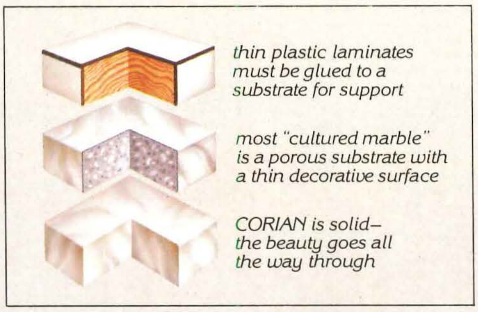

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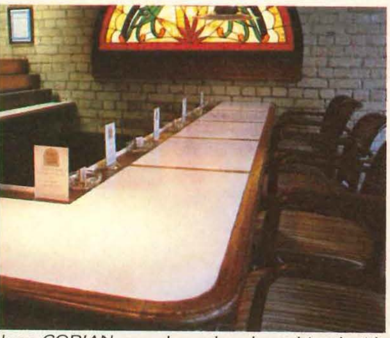

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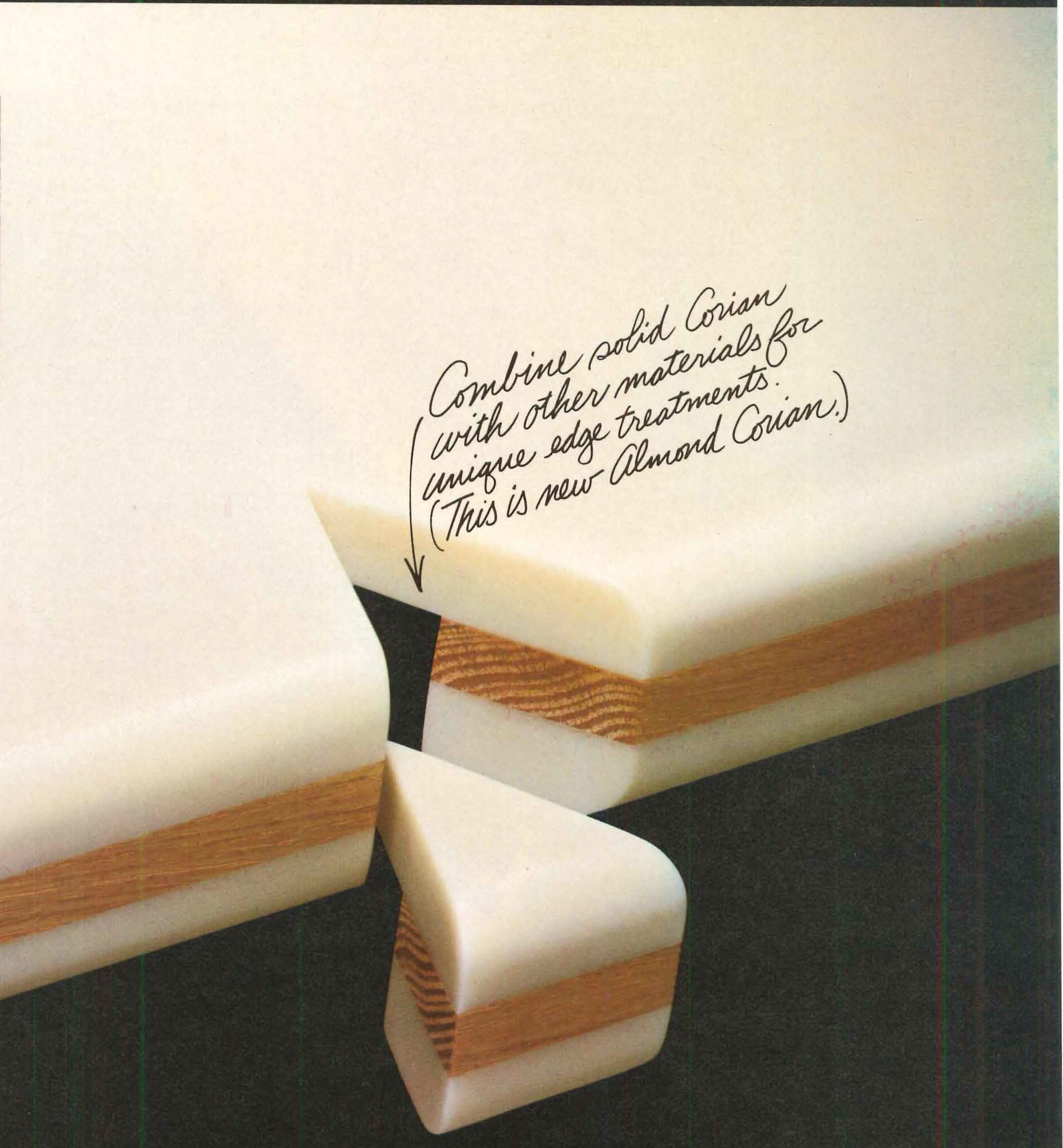

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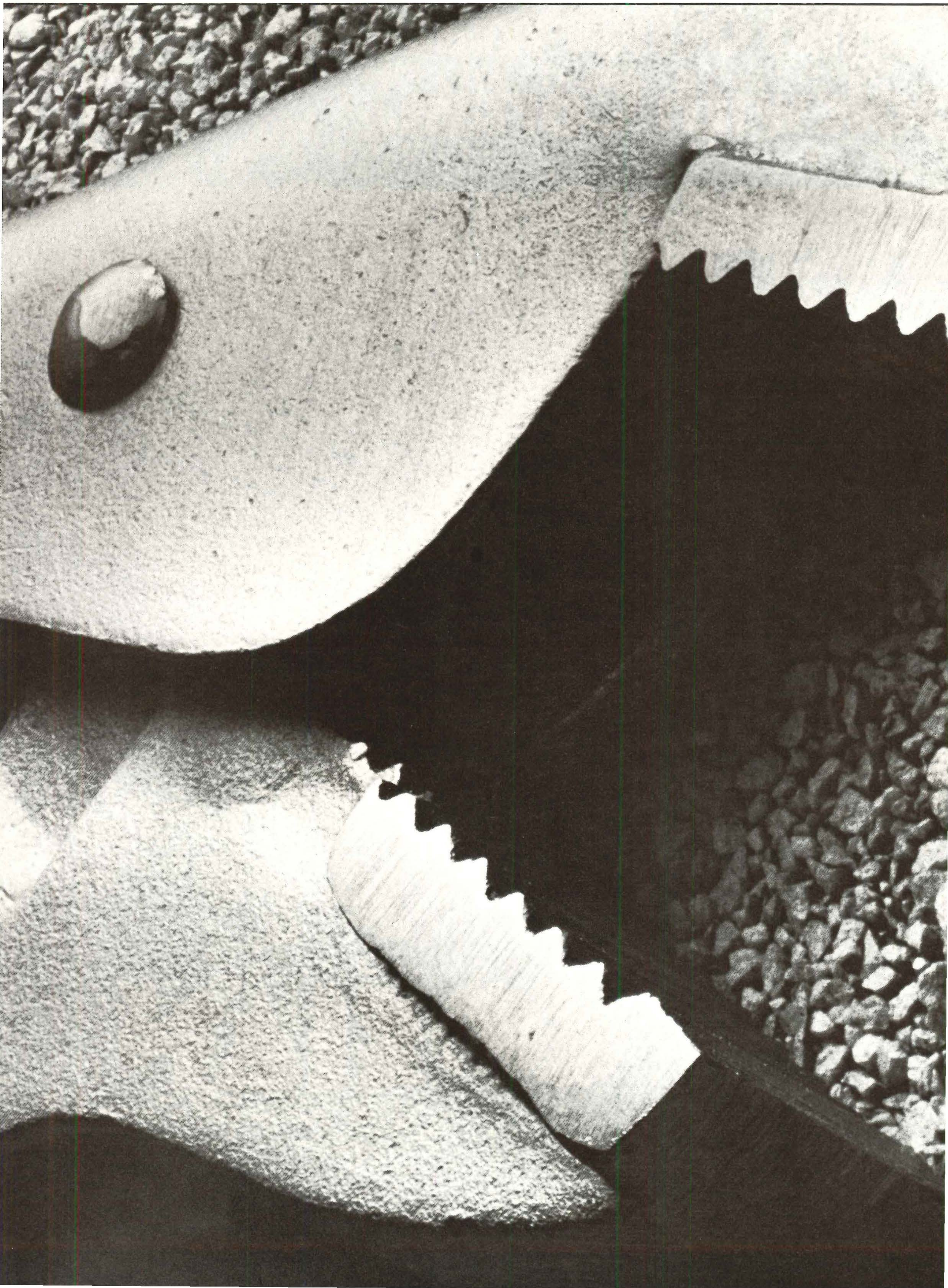

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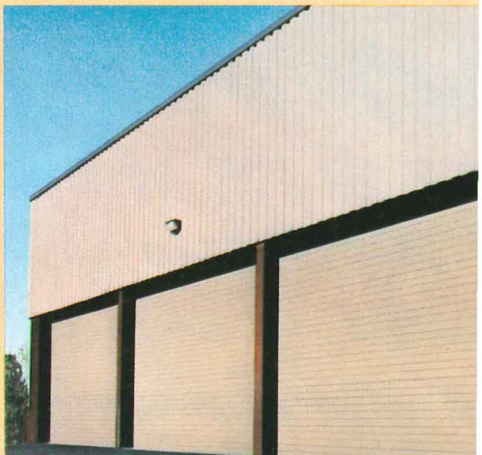

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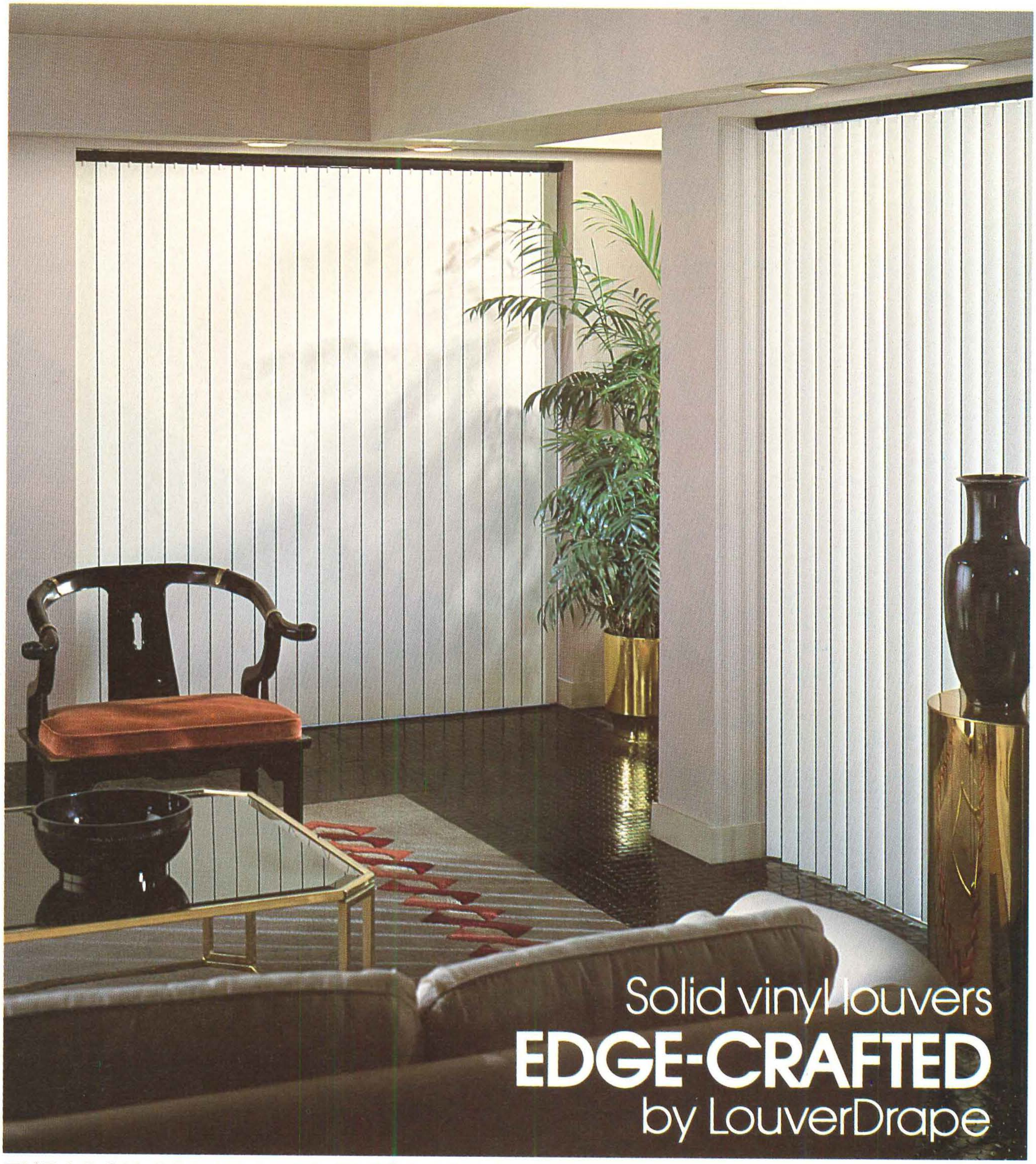

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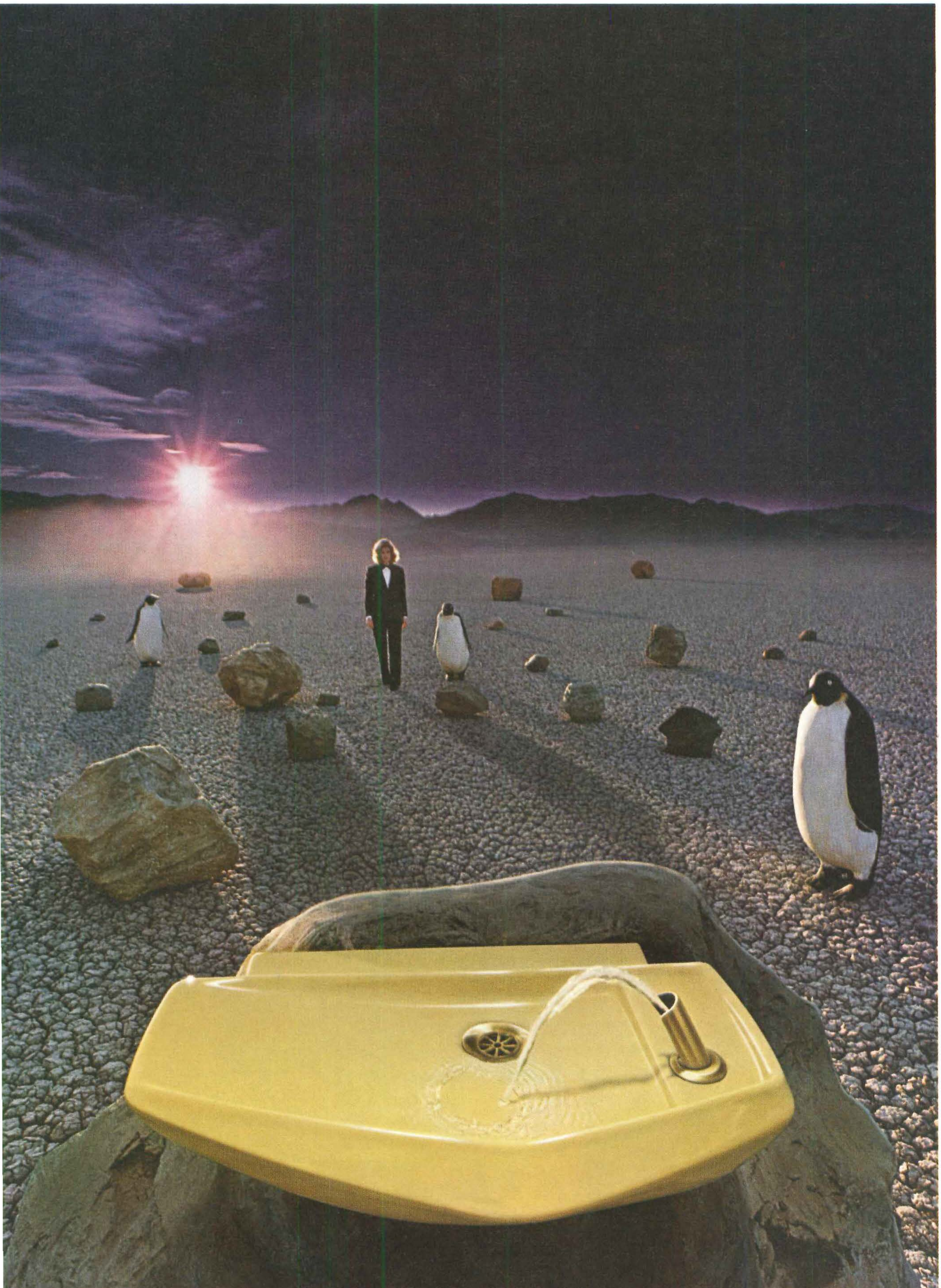


Pencil points

Academy honors

The prestigious Rome Prize for Architecture has been awarded by the American Academy in Rome to Frederic Schwartz (Venturi, Rauch & Scott Brown) and to Wendy Evans (I.M. Pei & Partners). Stacy Moriarty (Johnson & Richter, Avon, Conn.) received the Rome Prize for Landscape Architecture.

The NEA mid-career fellowships were awarded to the following individuals by field: Adele Chatfield-Taylor (Landmarks Preservation Foundation, New York), urban design and planning; Anna Bliss (Bliss & Campbell, Salt Lake City), interior design; Turner Brooks (Vermont) and Anthony Ames (Atlanta), architecture.

George Hines (president, GSW, Chicago) received the Graham Foundation mid-career fellowship in architecture.

Do you speak Italian?

The American Academy in Rome (headquarters, New York) is accepting applications for the position of Director of the Academy. The Director, who is responsible for planning and administering Academy operations, also serves as liaison to Italian institutions and other national academies in Rome and Italy.

The current director, Sophie Consagra, will replace Calvin Rand as Academy president next January.

Gazing into Aspen's crystal ball

Tackling a topic cryptically entitled 'The Future Isn't What It Used to Be,' the 33rd annual International Design Conference in Aspen, Colo., will convene June 12–17. The 1983 Steering Committee—Jane Thompson, planner and architectural writer; Milton Glaser, graphic designer; and Ralph Caplan, communications design consultant—plan a provocative inquiry into changing patterns of expectation and their impact on design.

Those called upon to present their forecasts for the future include Gerald Edelman, a molecular biologist and Nobel laureate; Steven Jobs, cofounder and chairman of the Board of Apple Computer; Robert Hughes, Time *magazine art critic and creator of the TV series 'The Shock of the New'; and Dollar Brand (Abdullah Ibrahim), a South African jazz pianist and composer.*

The conference will be immortalized in a Time Capsule, to be assembled, sealed and buried in Aspen. Conferees get to determine the proper contents, burial ceremony, and site marker.

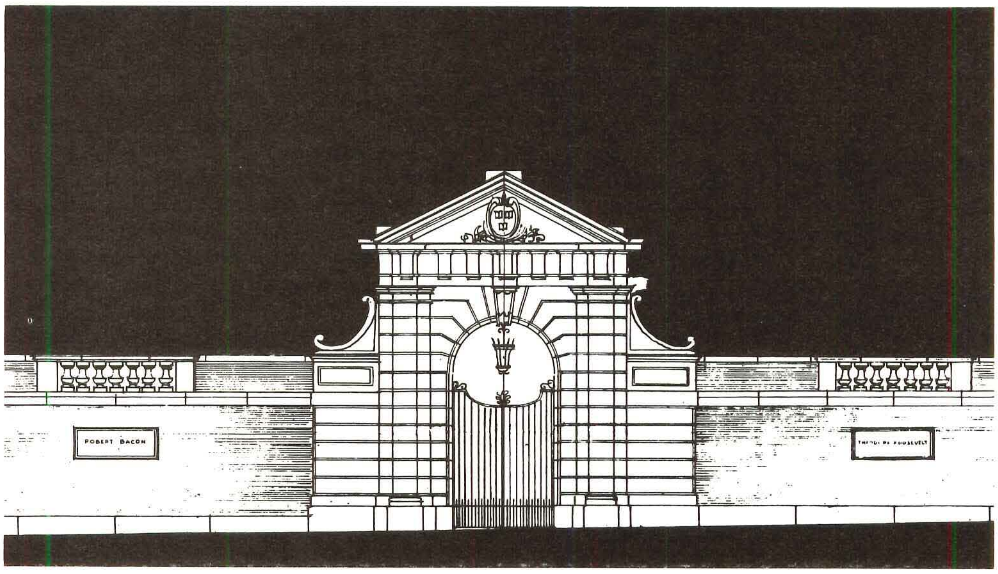
Parsons post filled

James Wines, president and cofounder with Alison Sky of SITE, has been named chairman of the Department of Environmental Design at Parsons School of Design, New York, and will take up the post in September of this year.

The recipient of numerous fellowships and awards for his architecture, sculpture, and graphic art, Wines was recently honored by the National Endowment Design

[*Pencil points continued on page 59*]

P/A News report



Prize-winning McKim, Mead & White/T. Bartels gate, from the competition poster.

Harvard Gate Competition

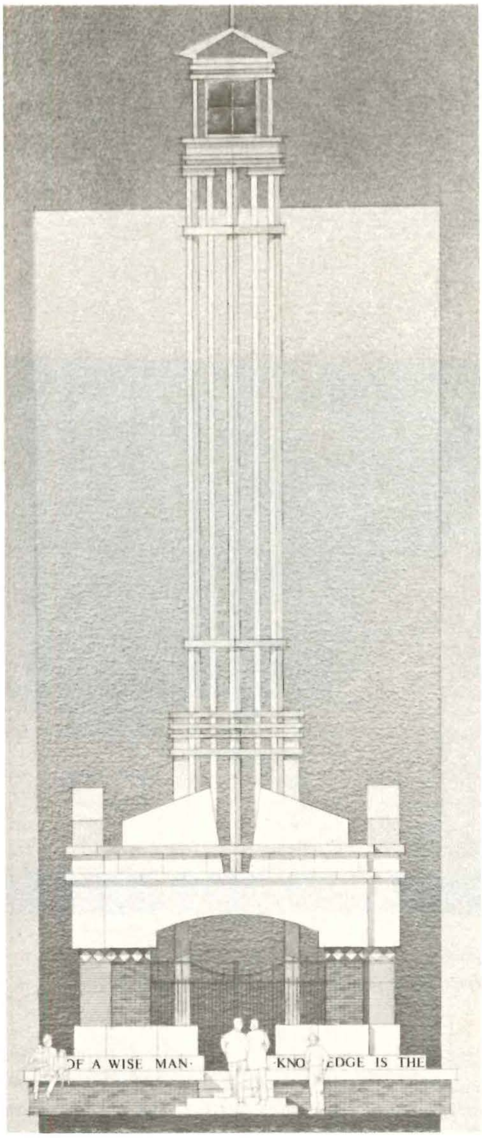
For its forthcoming fifth issue, the *Harvard Architectural Review* sponsored an open competition for a gate to its university. The gate, never intended to be built, is sited at the Quincy Street boundary between town and gown, where many of the university's more famous buildings of the 19th and 20th Centuries face off in a battle of the styles: Richardson's Sever Hall and Le Corbusier's Carpenter Center; Coolidge, Shepley, Bulfinch & Abbott's Fogg Art Museum and James Stirling's new Fogg Addition; Ware and Van Brunt's Memorial Hall and John Andrews' Gund Hall.

The competition proposed the theme of "precedent and invention," but the 311 entries, for the most part created by younger architects and students, indicate a marked preference for precedent over invention. The jury, composed of architects Henry Cobb, Jaquelin Robertson, Ed Jones, Stanley Tigerman, and Susana Torre and professors Laurie Olin and Anthony Vidler, seemed less than enchanted with this respectful attitude toward the past. Most projects that merely imitated prestigious or familiar models were eliminated, as were the clever caricatures of a croquet wicket or Harvard goal posts.

The jury's public deliberations on February 19 revealed an understandable desire to punish the "pastichers" and to praise more urbanistic solutions that respected the site. Fourth-place winner Frederic Schwartz produced the only serious proposal to restructure the irregular and messy crossroads with two gatehouses and a triangular traffic island. Craig Spangler and Stephen Bartlett, also fourth-prize winners, strung lanterns, globes, and lions along a corridor-shaped *place* formed of Vienna-inspired pillars. Third-prize winners Cary Tamarkin, Timothy Teckler, and Steve Johnson were criticized for their privatization of Quincy Street, which they closed to cars; yet their landscape plan earned praise.

The second-place winner by Sandra Parët, Andrew Roth, and William Ryan was, to judge from crowd reaction, a favorite for first. Inventive graphics showed nighttime and daytime views of their monumental obelisk, implanted in the amorphous intersection, as a landbound lighthouse. The first prize was awarded to Thomas Bartels for an adaptation of the competition poster. His brief manifesto termed the new gate superfluous; instead Lamont Library was to be razed to unblock an existing McKim, Mead & White gate, and a new building proposed on Quincy Street. Bartel's argument, "invention is an attitude that respects the site," was considered a unique critical comment on the competition. Yet a twin project from the same school, Virginia Polytechnic Insti-

News report continued from page 23



Top: second-prize design by S. Parët, A. Roth, W. Ryan; above: 4th prize design by F. Schwartz.

tute, made the same point (and designed the building as well). So did Montgomery Schuyler, who in 1909 argued that radical alterations to the Yard would be needed to make sense of its new furbelow of gates and walls.

The competition's success in attracting 311 high-quality projects from all over the world proves that although it may not make careers as can its legal brother, the *Review* is a significant bellwether for the concerns and designs of younger members of the profession. [Hélène Lipstadt]

Hélène Lipstadt *is a Cambridge, Mass., social historian and architectural writer.*

Washington update: DOE's energy priorities

The Department of Energy (DOE) recently released its budget for FY 1984, and unfortunately for proponents of energy-efficient buildings, it contained few surprises. The FY 1984 budget signals once again DOE's apparently firm resolve to spend very little on building-related research and to focus its remaining programs only on long-term, high-risk research. The budget does imply that DOE may not feel able to pull out of the energy-conservation and solar-research arena as quickly as it tried to last year, when it offered to spend only $22 million on all conservation programs and zero on its active and passive programs. Instead, Congress appropriated over $420 million for FY 1983, an indication of its continuing disagreement with DOE over the importance of these programs.

This year's budget confirms DOE Secretary Hodel's success in convincing the Office of Management and Budget (OMB), which controls DOE's purse strings, that the conservation programs merited a larger budget. The budget numbers also reflect the secretary's recognition that he needs to fulfill the promise made during his Senate confirmation hearing: "to pursue a more balanced energy policy."

Two years have given DOE ample time to reshape completely the conservation and solar programs. Setting Congressional and popular dissent aside, DOE moved to implement strictly both the Reagan Administration's belief that the federal government should be less involved in all energy activities and OMB's policy of funding only the long-term, high-risk, high-payoff research that industry is unlikely to undertake. DOE has terminated all other ongoing research that does not fit these criteria and applied its stringent rules to research in the conservation and solar programs. The FY 1984 proposed building-related activities leave no doubt that DOE is intent on completing the transition from a program that supports a mix of basic and applied research, as well as demonstration and commercialization activities, to one that has a very strict emphasis on materials, components, and other generic research activities, with no distinctions made between residential and nonresidential construction.

The proposed lineup for 1984

- *Energy conservation standards:* Performance- and component-based standards eliminated. Interim standards for ten commercial building types to be included in ASHRAE 90A-1980.
- *Whole buildings research:* No further activities in the areas of multifamily buildings or field research validation for small office buildings.
- *Ventilation and indoor air quality:* No additional research on indoor air pollution.
- *Diagnostic tools for commercial buildings:* DOE 2 and *DOE 2 Users News* terminated.
- *Passive and hybrid solar:* The passive and hybrid program eliminated, with some activities moved to the Solar Heat Technology Program. Most of the $5.6 million allocated for passive activities to be spent on long-term materials and components research (apertures, storage, and heat transfer). Only 20 percent to be spent on natural ventilation and daylighting research. Design tools development, performance monitoring and technology transfer eliminated.

The building community has been far from silent about the fundamental reorientation of these programs. During the past two years, many industry organizations have tried to convince DOE that the fragmented nature of the building community prevents it from taking over many of the applied research activities that were previously supported by DOE. Organizations that have an interest in DOE's passive solar program tried to negotiate with OMB for a more balanced program to no avail. DOE's own Energy Research Advisory Board (ERAB) concurred with these groups in a report urging greater recognition of the industry's structure and advocating more industry participation in the planning and technology transfer phases of DOE's programs. Even the final report from the President's own Commission on Housing recommended that the federal government should continue to fund research on total building performance.

Recently, the House Science and Technology Committee has stepped up its oversight of federal building-related research programs. Earlier this year, the house committee convened a workshop with the purpose of establishing a national agenda on building energy research. The participants reiterated the need for performance monitoring, design tool development, and more research on indoor air quality, passive solar strategies, and whole building performance. DOE participated in the workshop with the hopes of obtaining a "shopping list" of research projects, but ended up hearing again that the industry wants a balanced program.

Even though Secretary Hodel has been more conciliatory toward the conservation programs than his predecessor, the chances of reversing or modifying the direction of the building-related research programs are negligible. The Congress could reduce the department's discretion over its funding by specifying a line-by-line appropriations bill for these programs, or it could establish an advisory commission on building energy research. Both alternatives, however, leave the details of program planning to the department, which so far has heeded no outside advice save that of the President and OMB.

Some energy advocates suggest the nly real solution is more concerted olitical action by those building indus-y organizations that will support a fed-ral role in energy conservation and olar research. Proponents of this solu-on note that, while support on Capitol Iill for renewable energy is broad, it as not been focused sufficiently to af-ect major policy directions taken by the epartment. The chances for that level f political activity are slim for several easons. The economic health of the onstruction industry makes other legis-tive issues a much higher priority for nese organizations. Many legislative epresentatives still refrain from speak-ig out against the administration's eatment of energy programs because ieir companies originally endorsed the resident's campaign themes of less ederal spending and less federal regu-tion. Furthermore, the political fund-aising abilities of the industries that enefit from a national policy that en-ourages the use of energy conservation nd renewable energy technologies are nall when compared with the level of ontributions made by the traditional nergy industries. Nevertheless, many ustrated building industry representa-ves perceive a real need for an ndustry-wide political action committee iat could effectively represent, in DOE nd in Congress, the pressing energy oncerns of product and equipment ianufacturers, the design and con-ruction community, and the owners nd users of America's buildings. Mary Ann Eichenberger]

Iary Ann Eichenberger *is director, Gov-rnment Affairs, with the American Institute Architects. This article is not the official osition of the AIA on these issues.*

Daylighting n Phoenix

ome 450 daylighting and energy en-iusiasts flocked to Phoenix, Ariz., to articipate in the 1983 International aylighting Conference, Feb. 16–18. Iany were surprised and pleased over ie course of the three-day conference conclude that here (at last) was an iergy-related subject in which archi-cts, researchers, utility executives, overnment officials, and even real es-te developers could find common round.

In a series of alternating plenary and chnical paper sessions, attendees eard presentations on topics as diverse Alvar Aalto's skillful exploitation of aylight (Richard Peters, Berkeley) and ie latest efforts to produce "user-iendly" computer programs for day-ghting analysis during design de-elopment (Harvey Bryan and David rinkel, MIT, and Claude Robbins, ERI).

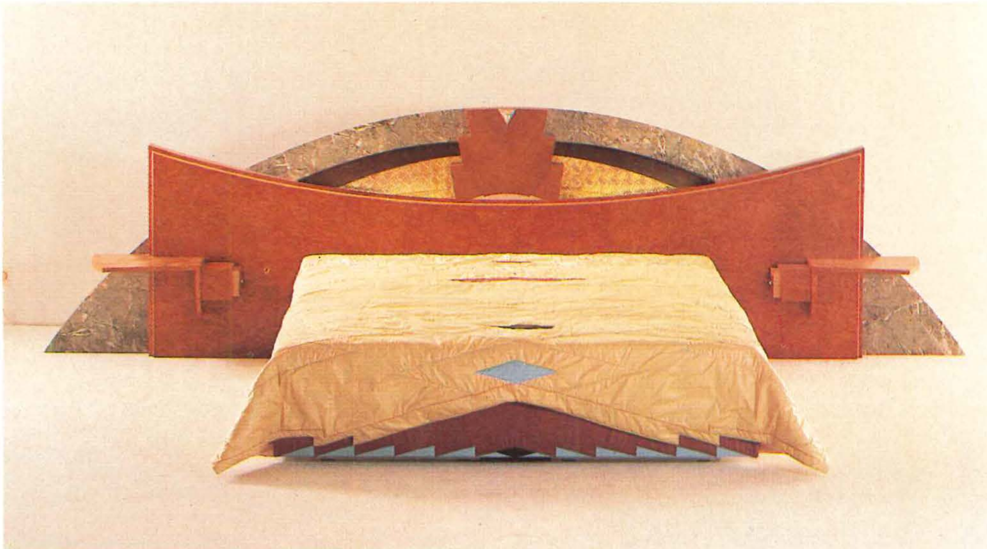
It was refreshing to hear daylighting searchers concede that energy eco-omics alone cannot provide reasons ompelling enough to turn to daylight-g. "It is clear," said Lawrence Berkeley aboratory's Stephen Selkowitz, one of the two conference cochairmen, "that the visual quality of environments and their architectural properties are the important factors." Heartening to some was the tribute paid to the contributions of research to design, notably by archi-tect Scott Ellinwood of Ventura, Calif., whose innovative office building for a California canning company "would not have been possible without the useful and nonbiased research that has come from the government."

Selkowitz and cochairman Harrison Fraker, Jr., summed up at various points the main themes of the confer-ence. Often-mentioned topics of con-cern included the need for better in-formation on the actual performance of various daylighting strategies, the sig-nificant links between lighting and worker productivity, and the paucity of information documenting the efficacy of various lighting control systems.

The impact of increased computer and CRT use on office lighting was mentioned repeatedly as a subject in need of further study, but the topic re-ceived little in the way of detailed treat-ment in the technical papers. The tradeoffs and interactions between light-ing and thermal energy systems were also identified as areas of lingering diffi-culty.

One session was devoted to reports from foreign attendees on develop-ments in daylighting research abroad. One particularly impressive report from the United Kingdom attributed the in-crease in available solar energy to the country's aggressive clean air efforts.

Sponsors of the conference were the AIA, ASHRAE, the Edison Electric In-stitute, the Electric Power Research In-stitute, the Illuminating Engineering Society, Lawrence Berkeley Laboratory, Oak Ridge National Laboratory, the U.S. Department of Energy and the Commission Internationale de l'Eclai-rage. Proceedings of the conference have been published and are available from the AIA. [Thomas Vonier]



Hollein design for Wittmann.

Hollein headboard

Hans Hollein has designed a second piece of furniture. His first was a vanity (P/A, May 1982); his latest is a bed with curved headboard and suspended side tables, designed for Franz Wittmann, Austria. It is to be unveiled at the 1983 Cologne Furniture Fair.

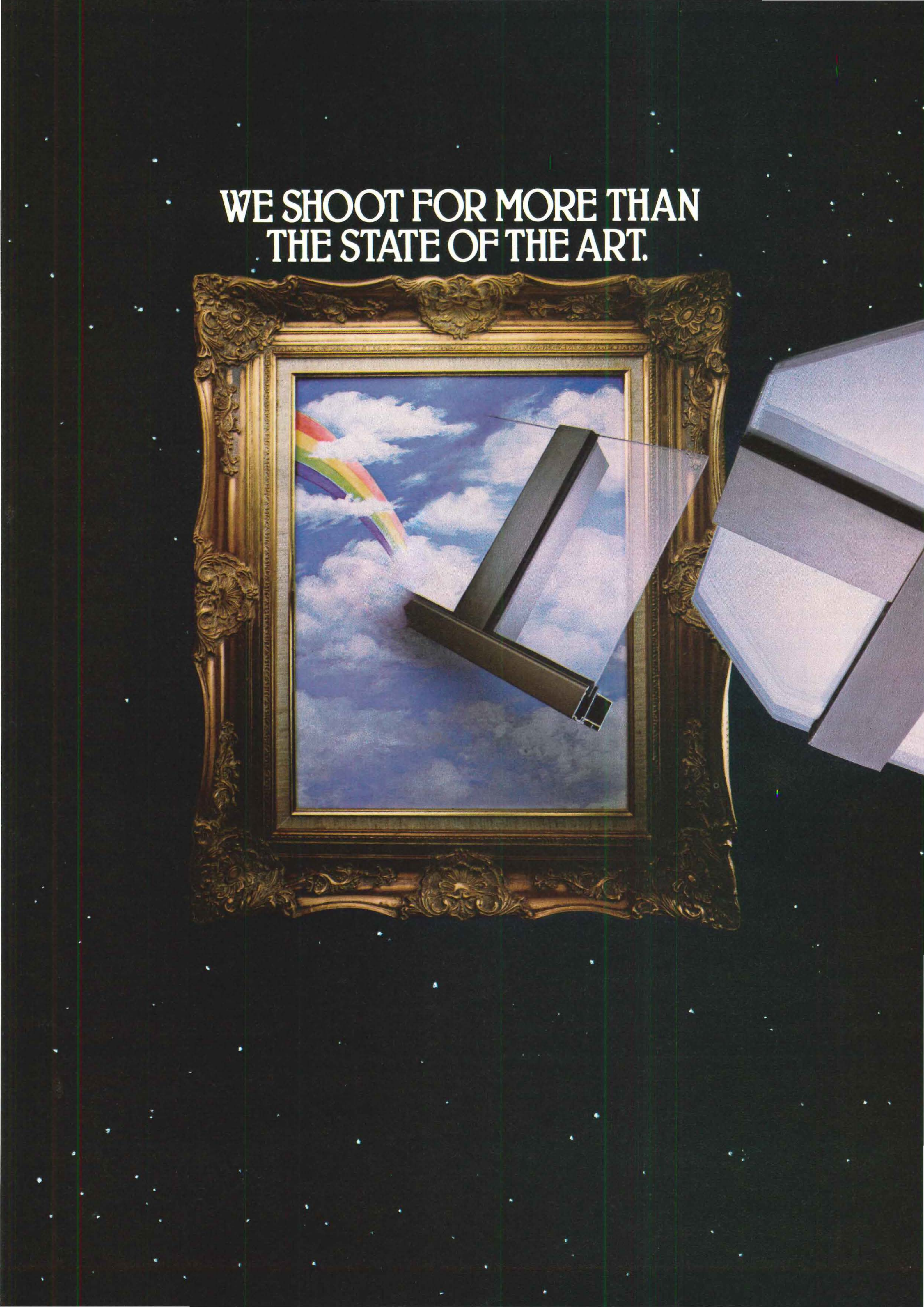
Constructed of Wawona burl wood, mother of pearl, gilded aluminum, pink acrylic, marble laminate, and built-in Philips lamps, the bed is at the very least a lavish item. The ensemble is available in two sizes with four different bed units. The bedspread's vaguely Navaho motifs are patterned in chintz and skin of water snake.

Two-stage competition for German Energy Center

Essen, a major city in the industrial Ruhr area of West Germany, has for the past two years been planning a center devoted to the study and demonstration of energy issues. The city staged a two-part competition for the design of this German Energy Center, with the first phase held in 1981, and the second stage to take place this year. Invited to participate in the first phase were archi-tects Hans Hollein of Vienna, Harald Deilmann of Munster, Planungsgruppe Me di um of Hamburg, Bernd Faskel and Vladimir Nikolic of Kassel, and Erich Schneider-Wessling of Cologne, each with associated engineers and energy consultants.

The 220,000-square-foot Energy Center will have three functions: a natural science and technology museum with demonstration areas, archives, and 90,000 square feet of exhibition space; a forum for technological and scientific interchange; and an interdisciplinary research institute. Close to half a million visitors are expected to visit the museum yearly, 50 percent of them students. The architects were asked to propose

[*News report continued on page 28*]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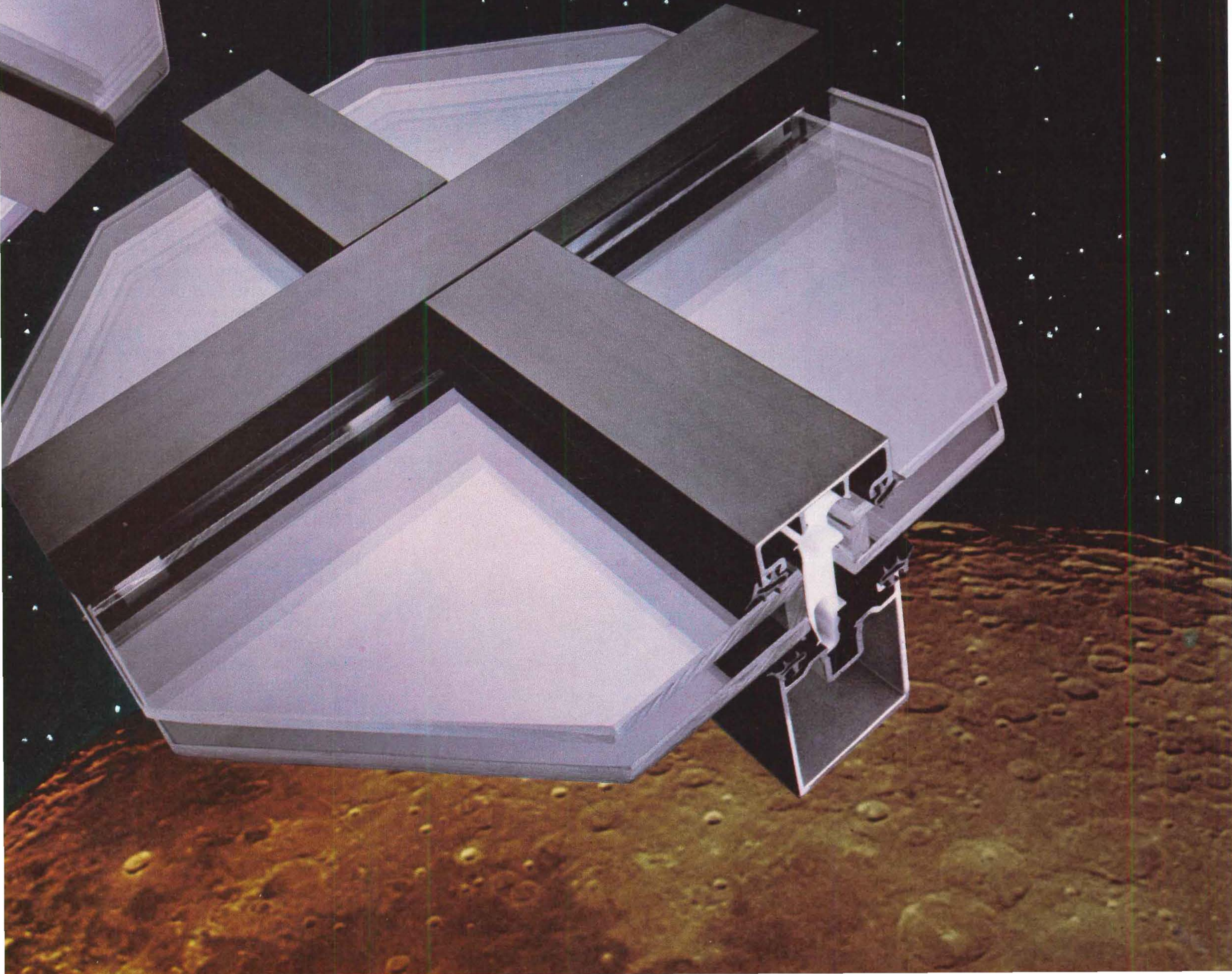


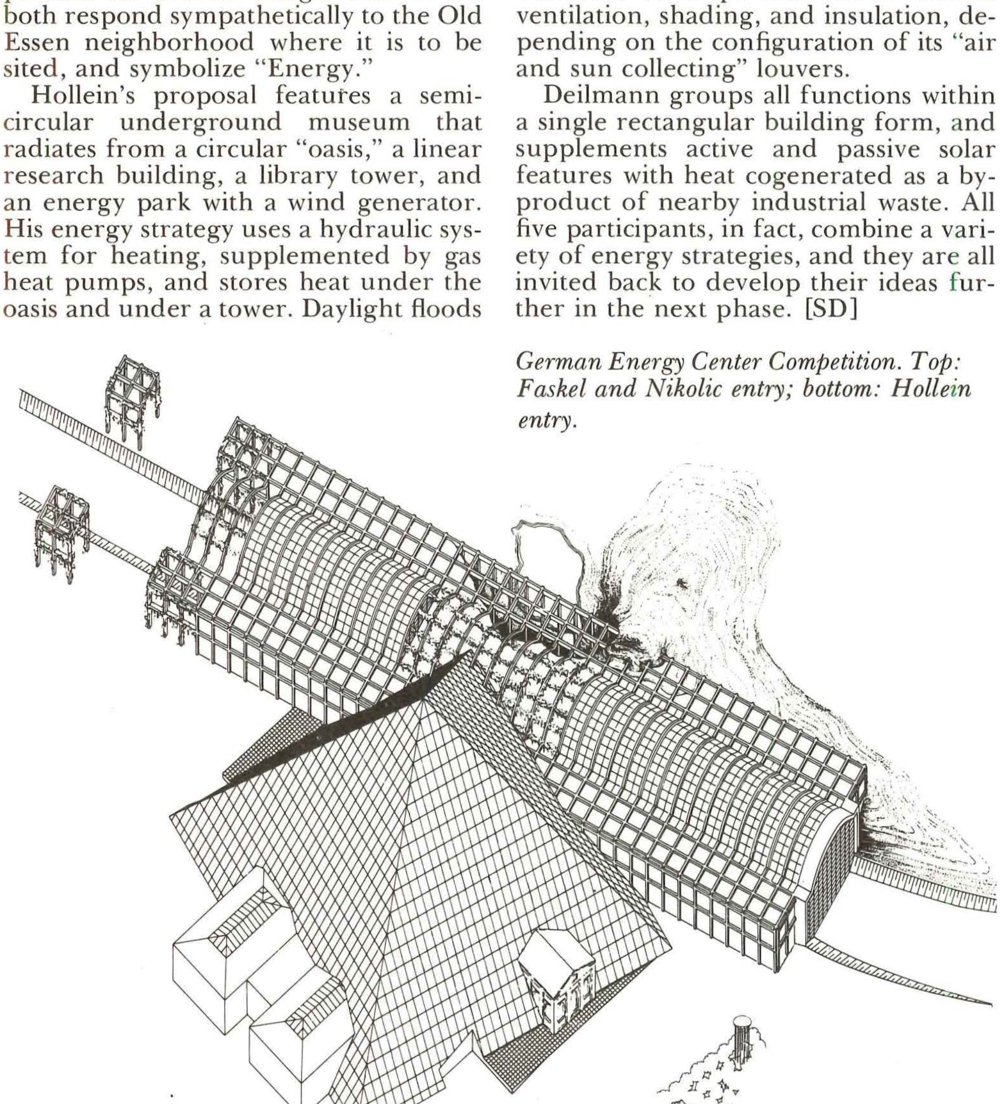
News report continued from page 25

concepts for the functional, structural, and energy organization of the center, to search for innovative ideas, and to present an overall design that would both respond sympathetically to the Old Essen neighborhood where it is to be sited, and symbolize "Energy."

Hollein's proposal features a semicircular underground museum that radiates from a circular "oasis," a linear research building, a library tower, and an energy park with a wind generator. His energy strategy uses a hydraulic system for heating, supplemented by gas heat pumps, and stores heat under the oasis and under a tower. Daylight floods into the glazed entry spine and oasis, while underground exhibitions spaces demonstrate the historical development of artificial light sources.

Faskel and Nikolic propose a giant pyramid enclosing the museum, with an elaborate envelope that allows natural ventilation, shading, and insulation, depending on the configuration of its "air and sun collecting" louvers.

Deilmann groups all functions within a single rectangular building form, and supplements active and passive solar features with heat cogenerated as a byproduct of nearby industrial waste. All five participants, in fact, combine a variety of energy strategies, and they are all invited back to develop their ideas further in the next phase. [SD]



German Energy Center Competition. Top: Faskel and Nikolic entry; bottom: Hollein entry.

Manville claims fund established

In August 1982, the Manville Corpora tion and its subsidiaries filed plans fo reorganization pursuant to Chapter 1 of the United States Bankruptcy Code This move resulted from the extraordi nary financial burden of present and an ticipated litigation related to the asbes tos health issue. While Manville authorized to continue business as usua during its reorganization, and whil warranties and guarantees remain i full effect, the company sought a way t reassure customers of their protection

To that end, Manville established separate multi-million dollar third part trust fund in January, with the Mello Bank of Pittsburgh as the fund truste The fund, plus its investment interes will be held as a reserve for payment o bona fide claims connected with roofin materials and fiberglass building insula tion should Manville ever be unable t fulfill its business obligations.

The basis for deciding the prope amount for the fund was an actuaria analysis of claims on roofing and insula tion warranties and guarantees over th company's history. Assets in the fun are calculated to equal approximatel one-and-one-half times the amour Manville typically has paid on suc claims in the past. [JM]

Nathaniel Owings: Solid gold

Nathaniel Owings' 79 years have no diminished his capacity for speaking hi mind: "We are corrupting nearly every thing we touch," said the 1983 AIA Gold Medalist at a recent luncheon hel in his honor. "Everywhere we look ther is poisoning and desecration of the envi ronment, and I intend to press this ma ter on the Institute."

Owings will have a chance to do s during the New Orleans AIA conver tion at which he will accept the Inst tute's highest honor, the Gold Meda Describing himself as an uncharacteri tic and unlikely recipient of the award Owings compared the honor to that o another environmentalist and Gol Medal winner, Clarence Stein. He no intends to urge on the AIA creation o an entire division—on a par with prac tice, design, and education—devoted t the environment.

Owings, the AIA's 44th medalist an a founding partner of Skidmore Owing & Merrill, was appointed in 1962 b President Kennedy to chair Washing ton's Pennsylvania Avenue Commissio He held that post for 20 years and du ing that time solidified his position one of America's foremost conse vationists. "I conclude," Owings sai "that if architects don't take this on, n body else will . . . not engineers, n businessmen, not the goverment. Buil ings can come down and we will live o but the environment is fundamental all that is worthwhile in life."
[Thomas Vonier]

[*News report continued on page 33*]

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Iews report continued from page 28

'assive Solar Design Competition

ix of the seven winners of the Second National Passive Solar Design Competition 'P/A, Oct. 1982, pp. 28–29) are shown here he seventh is featured on p. 86). They indiate the diversity of current energyonscious design.

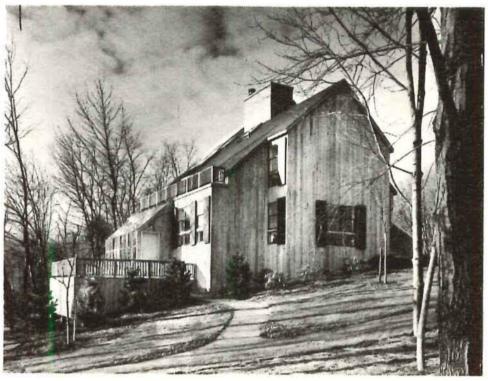
a, b Con Edison Demonstration House, riarcliff, N.Y.; *Architect: Alfredo De Vido, Iew York; Solar consultants: Princeton Energy roup, Princeton, N.J.* Commissioned by Con dison to demonstrate methods of saving nergy, this well-insulated house (R-27 walls, -30 ceilings) features movable insulation, xtensive south glazing sized according to e thermal mass and shaded by trees to preent overheating in summer, an attached reenhouse with a 6-inch concrete slab for irect gain, a heat exchanger, and a solar omestic hot water system. The architects nticipate a 40 percent saving in energy over house with conventional climate controls.

Wildwood Place Residential Townouses, Seattle, Wash.; *Architect: Eric Meng ssociates, Seattle, Wash.* These eleven townouses, clustered around a south-facing ourt, have stepped plans and sections to aximize their solar exposure. Each has an ttached sunspace, a 4-inch concrete floor ab, with balcony and roof decks of hollow oncrete planks through which hot (or cool) ir is circulated, cross ventilation, and exerior shades and overhangs designed to cool e houses in summer. Roof-top light-scoops ompensate for the lack of north-facing indows.

a, b Lake House, Micanopy, Fla.; *Architect: onald W. Haase, Gainesville, Fla.* Located bede a lake in a hot, humid climate, this house ses exterior shading and natural ventilation s its primary cooling strategies. Ceiling fans ull cool air through the porch windows and xhaust warm air through the open stair ower. Woodstoves and an attached reenhouse warm the house in winter. The ouse lends itself to seasonal zoning, with a rge, enclosed kitchen serving as the winter ving room, and a large, screened porch for ummer activities.

San Francisco Residence; *Architect: Villiam Leddy, San Francisco; Structural: Robert endall, Lafayette, Calif.; Mechanical: Edward rady, San Francisco; Solar: Douglas Taylor, an Francisco.* This expansion and retrofit nproves upon an undistinguished house on narrow, sloping site and accommodates its mited solar exposure by placing the unspace on the third floor. There, a return ir duct moves heated air to rock-bed storage n the garage. An existing gas-fired, forcedir furnace backs up the solar hot air system. Domestic hot water is also solar generated. t the back of the house is a canvas-shaded, outh-facing outdoor room, whose cooler air drawn into the house through operable indows to replace warm air exhausted rough a ridge vent.

News report continued on page 34]



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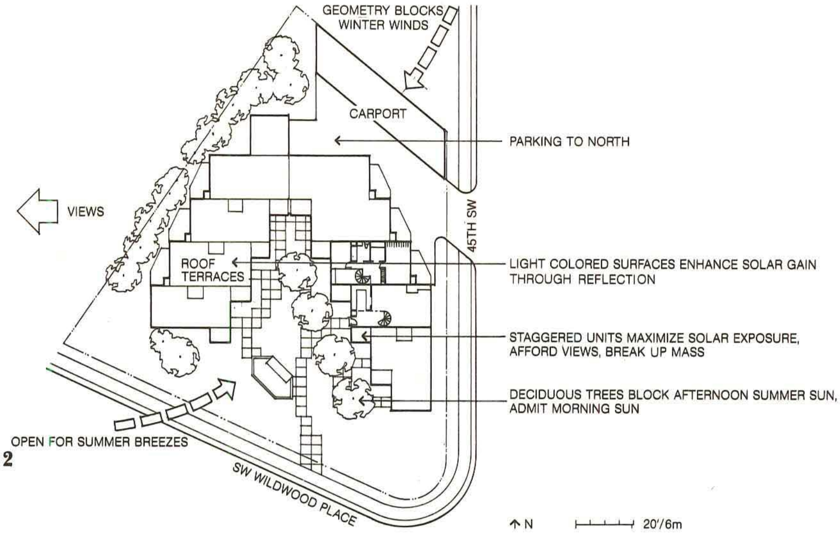

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SOUTH ELEVATION
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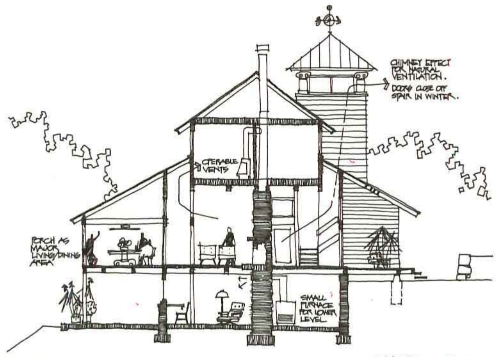

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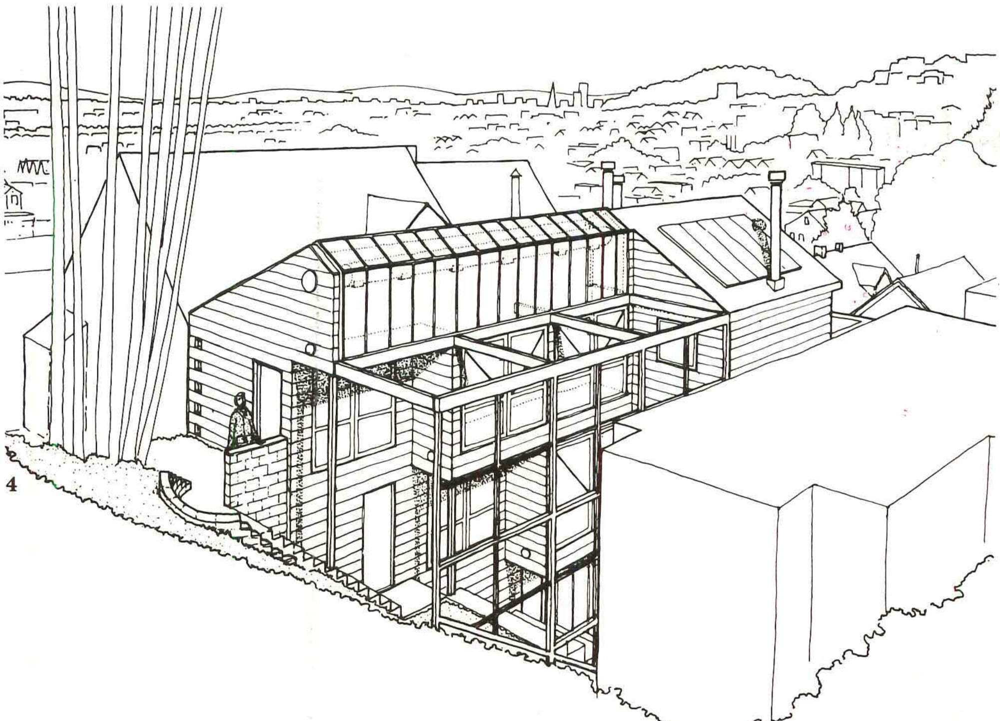

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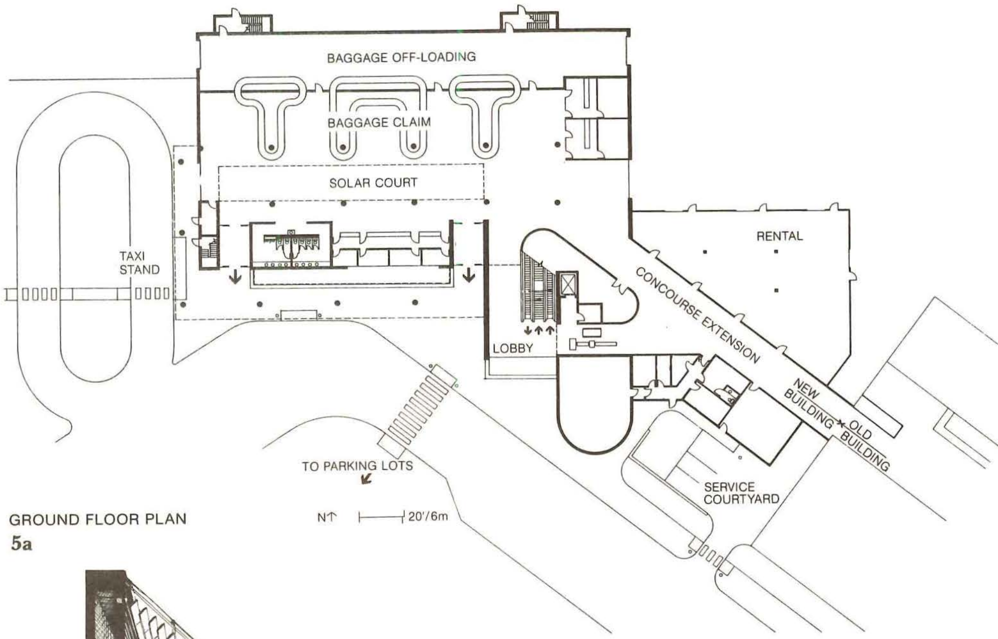
News report continued from page 33

5a, b Albany County Airport Terminal, Colonie, N.Y.: *Architect: Einhorn, Yaffee, Prescott, Krouner; Consultants: W.S. Fleming Associates, Albany; Scott-Healey Associates, Albany; Parsons-Brinkerhoff, New York.* A 176-foot-long solar court dominates this terminal expansion. Interior foam-filled louvers in the court are operated by a computer so that, in winter, the sun is allowed to heat the black slate floors and the brick walls, and in summer, the sun is reflected to prevent overheating. A thermal siphoning system, which exhausts hot air in the summer, integrates the solar court's air with high efficiency boilers and a VAV distribution system. That, along with efficient fluorescent lights, ample task lighting, and photocell sensors, allows the building to use 75 percent less energy than the adjacent, equally sized terminal.



GROUND FLOOR PLAN
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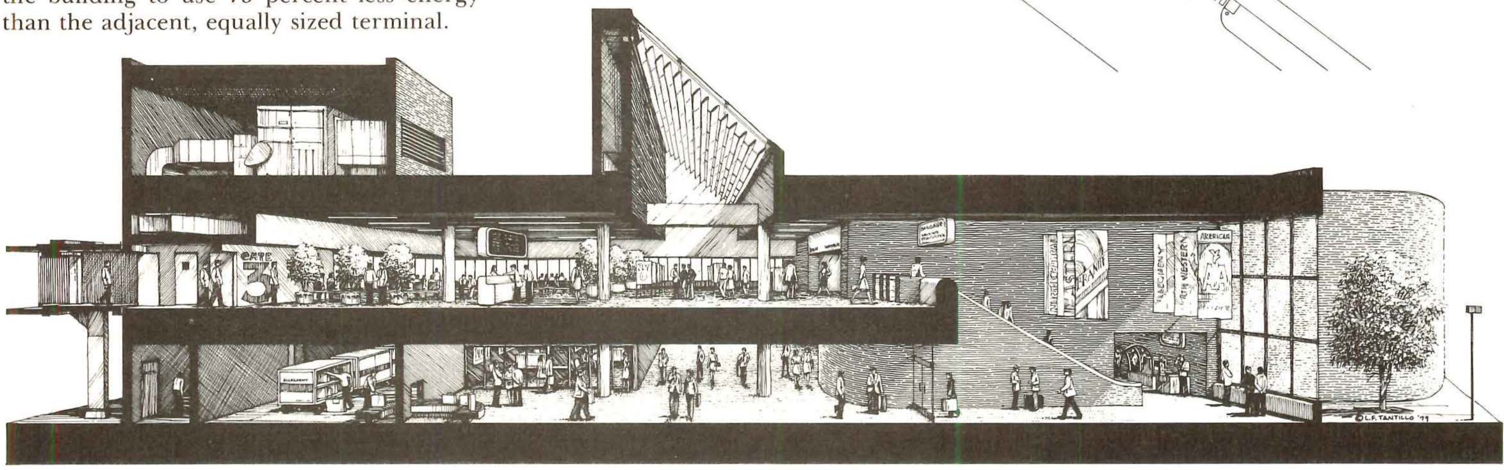

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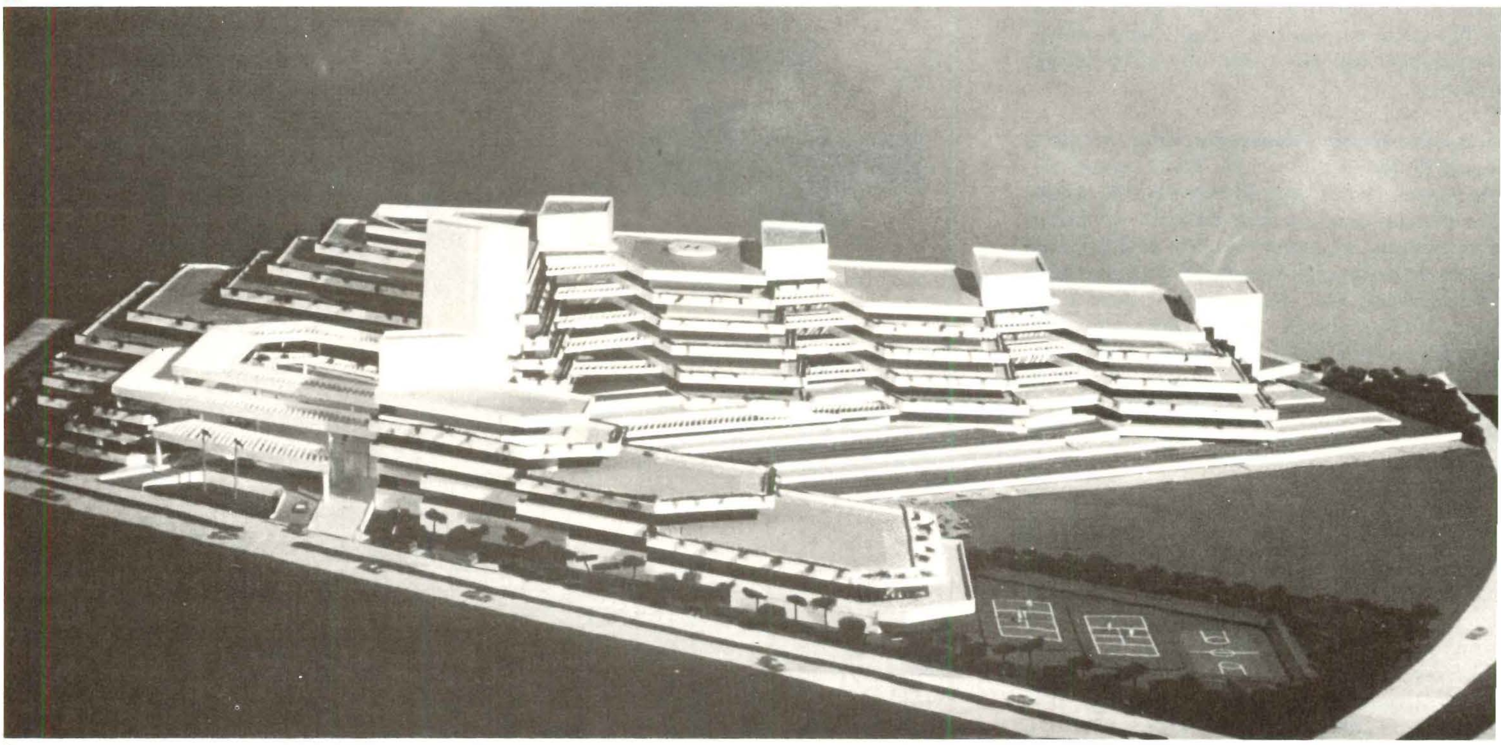

6

6 Government Service Insurance System Headquarters Building, Manila, Philippines; *Architects: Jorge Y. Ramos & Associates, Manila; The Architects Collaborative, Cambridge, Mass.* Its design process as much as the final product distinguishes this 1,350,000-square-foot office building. Wind-tunnel tests, daylighting studies using large-scale models, and computerized thermal analyses helped determine not only the building's long, stepped form, but its north-south orientation reducing heat gain, its notched elevations catching prevailing breezes, and its light shelves and reflective ceilings promoting daylighting. The anticipated energy consumption is 29,000 Btu/sq ft/year.

[*News report continued on page 39*]


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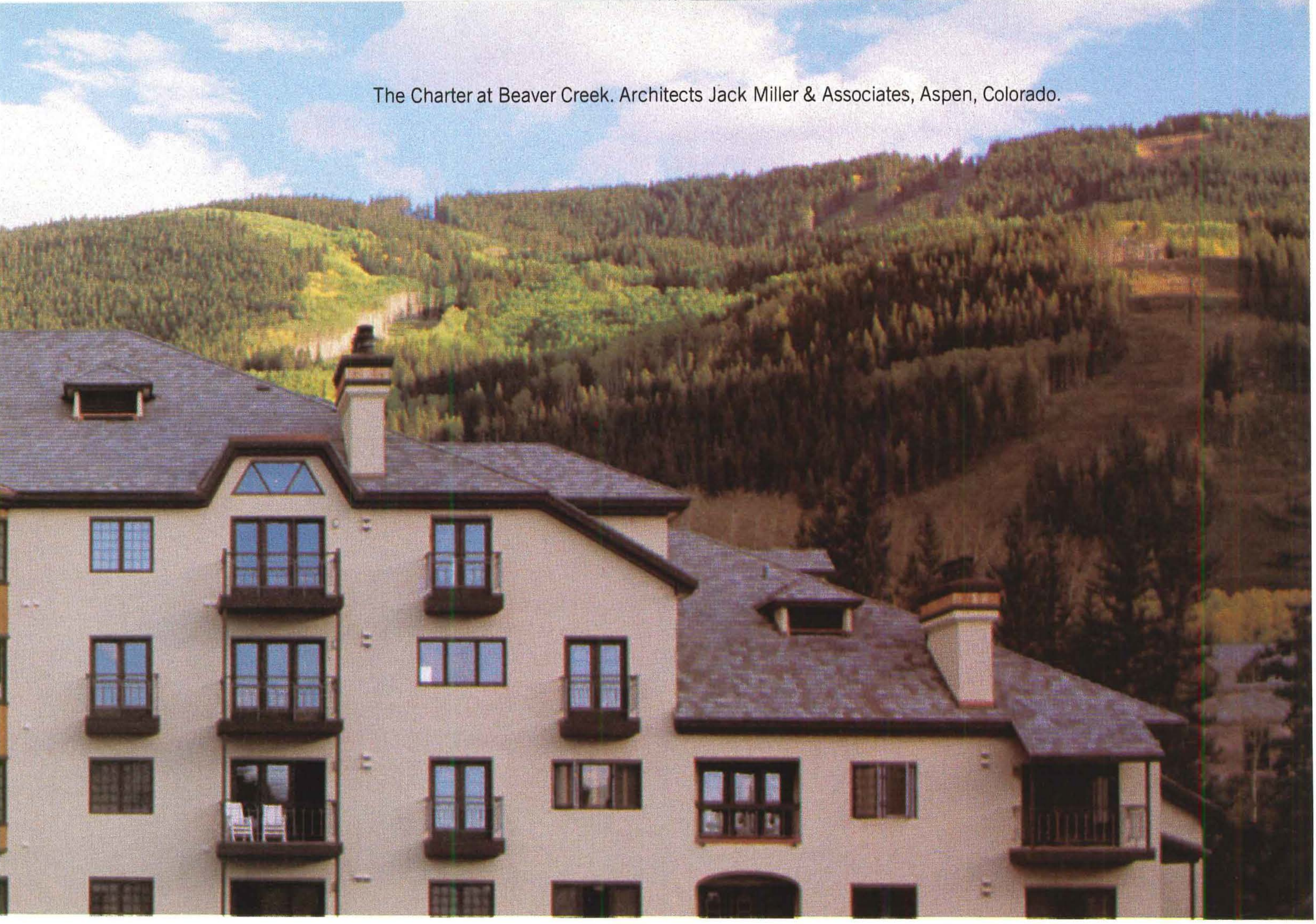

The Charter at Beaver Creek. Architects Jack Miller & Associates, Aspen, Colorado.

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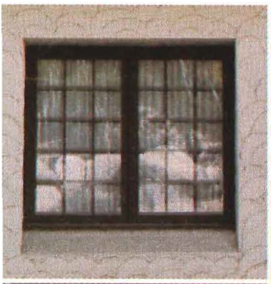
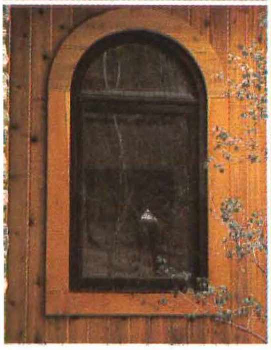


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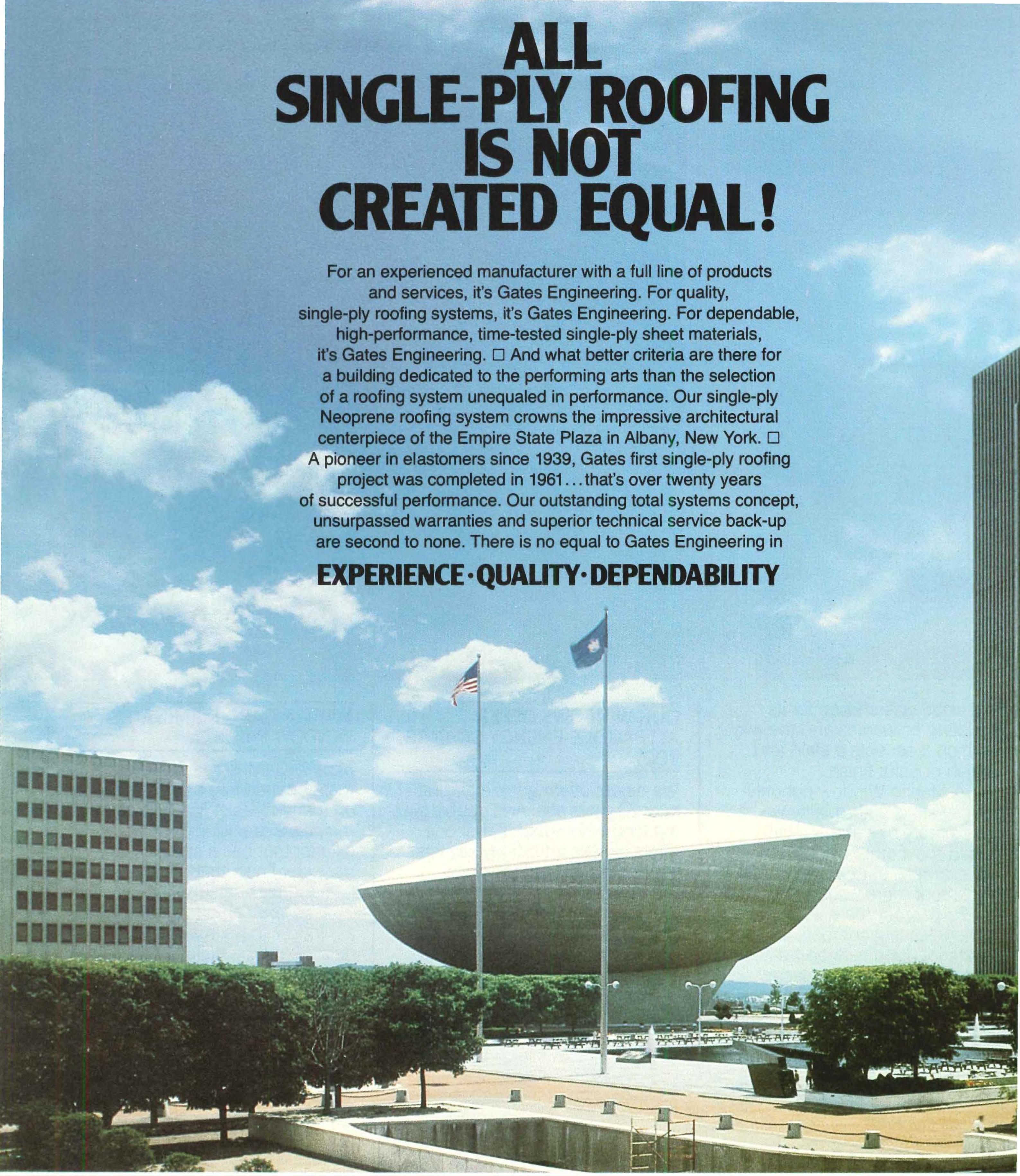

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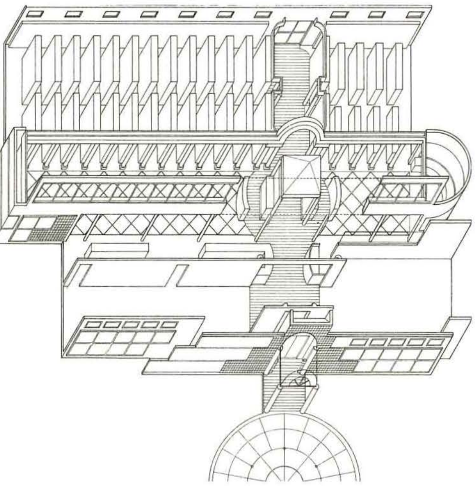
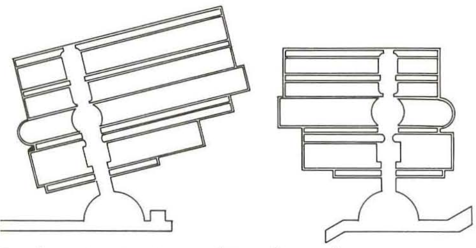
News report continued from page 34

Energy portfolio





Fraker: prototype and two branches.

Variations on a theme

Harrison Fraker, Architects, Princeton, N.J., opted for the kit-of-parts approach in their eminently energy-efficient solution(s) for six Mercer County Branch Libraries. The prototypical plan operates as an adjustable series of parallel layers, organized to allow the advantage of linear expansion when required. These layers are anchored by a perpendicular axis, the principal path of movement through the building, which is marked by a pyramidal skylight, a "gazebo" for new books, and a picture window.

The energy solution complements this zoning of programmatic components. Energy elements—clerestory windows, Trombe walls, and thermal storage columns—outline the edges between layers, most notably in the line of Kalwall water tubes that form a "loggia" between the reading room "agora" and the stacks. The combined impact of daylighting, natural through-building ventilation, and effective heat storage should reduce energy consumption to an estimated 23,000 Btu/sq ft/year, less than half the recommended BEPS standard of 50,000 Btu/sq ft/year. The system is appropriately flexible, with adjustable artificial lighting, operable windows, and thermal clerestory curtains.

The separation of zones, so clear in plan, is less evident in section and elevation. But the prototypical diagram is carried through in a generally consistent fashion, the extent of the zones adjusted to the branch programs. The branches are further distinguished by rather intricate two-dimension façade designs, color-coded for each site.

Energy ambassadors

Built to commemorate the Tennessee Valley Authority's 50th anniversary, two converted barges are mobile demonstrations of energy and conservation principles. On-board programs illustrating the power authority's past and advocating consumer awareness of energy issues are augmented by the operational example of these energy-efficient barges. The superstructures were fabricated from surplus construction steel at the 1982 World's Fair, where the barges began their journey, and enclosed in lightweight industrial materials. Central skylights illuminate the interiors; operable vertical louvers provide shading and direct the air flow. Large ridge vents permit passive cooling, and photovoltaic power systems provide a portion of the lighting load.

The 10,000-square-foot barges, which were designed by TVA's architectural design division, will visit some 23 sites along the Tennessee and Mississippi Rivers during 1983. With their bright primary colors, festive graphics, and playful profiles, they broadcast the message that energy isn't just practical; it's fun.

[*News report continued on page 42*]

TVA barges in situ.

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Introducing...
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The Performer. New from Kawneer.

The window that does everything.

The Performer, Kawneer's High Performance Inswing Casement Window System can provide the varied range of functions today's buildings require—ventilation, washing from interior, emergency, and fixed glass holding. In addition, The Performer offers light and sound control, as well as state-of-the-art thermal control.

The window that survived everything.

The Performer earned its name by surviving a comprehensive regimen of tests designed to prove its life-cycle claims. Heat loss and gain, sound and light control, as well as condensation resistance were all considered. But, even more important, high performance air and water infiltration resistance, structural performance, corner joinery strength, and even ease of glass replacement factors were also required for The Performer to live up to strict Kawneer standards for a lifetime.

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The window that works anywhere.

The Performer is ideal for hospitals, schools, government buildings, office buildings, airport areas, and many other applications where multiple functions would be an added dimension to a building's appeal. For renovation projects, The Performer System can be easily and aesthetically integrated into remodeling, allowing maintenance of the original design charm while meeting contemporary performance standards.

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Long after the bid is history, the performance of a window will keep appearing on a building's bottom line. The ability of a multi-function window to retain its design integrity through years of service and exposure to the elements is what makes The Performer an important consideration for your next project no matter what your design requirements are.

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Kawneer
The designer's element

Ventilation

Circle No. 361

Can be washed from interior

Emergency Exit

Accommodates

News report continued from page 39

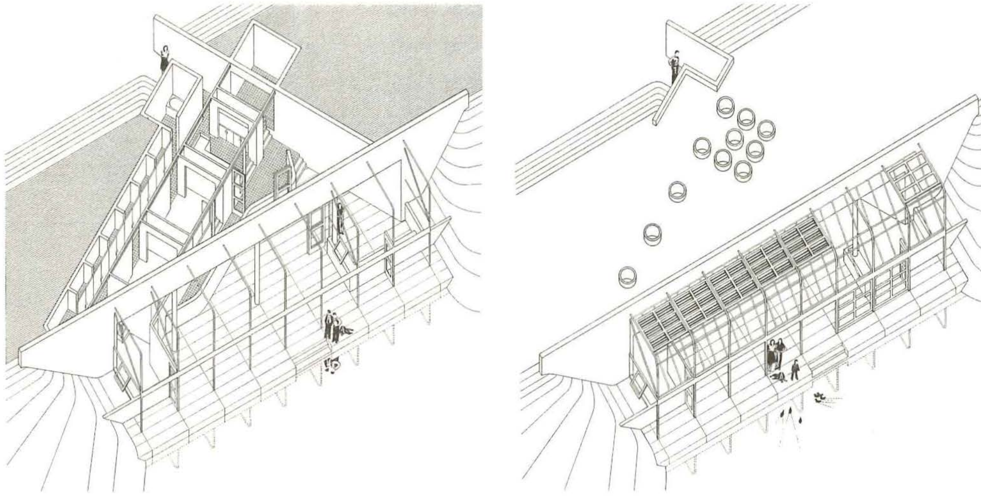
Well grounded design

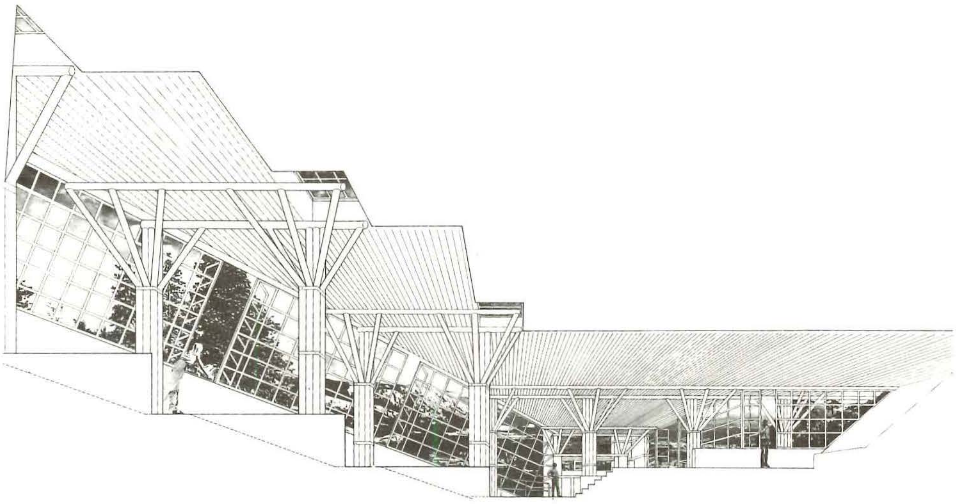
"Embarrassingly ugly projects have been spawned by a very narrow definition of what earth-covered and solar design mean." So concludes the Miller/Hull Partnership, a firm that has designed two striking earth-sheltered houses in Washington State.

The first, a house for a private contractor, stands on a flat, seven-acre site. Poplar trees and earth berms shelter the house's north, east, and west exposures. The south elevation, framed by a broad retaining wall and facing a pond, features a series of glazed garage doors that open to shade the sloped glass roof in summer and close to create a direct gain greenhouse with rock-bed storage in winter. A raised platform, set into the hillside and skewed in plan, contains service and sleeping areas, lighted by round, operable skylights. Ingeniously low-tech, the house suffers mainly from a somewhat tunnellike entrance.

An awkward entrance through the garage also plagues Miller/Hull's second earth-sheltered house. This ranch residence makes the best of its steep site, though, by cutting diagonally across the southwestern slope to face due south. A shallow ramp connects the various levels as they step up the hill; glazed garage doors enclose the concrete ramp, allow-

[*News report continued on page 46*]





Two by Miller/Hull: top, contractor's house; above, ranch residence.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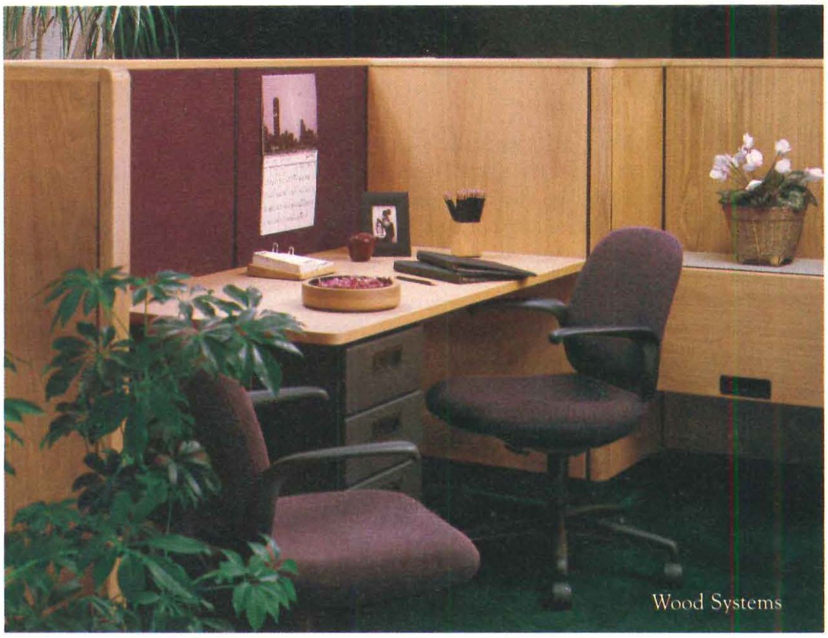
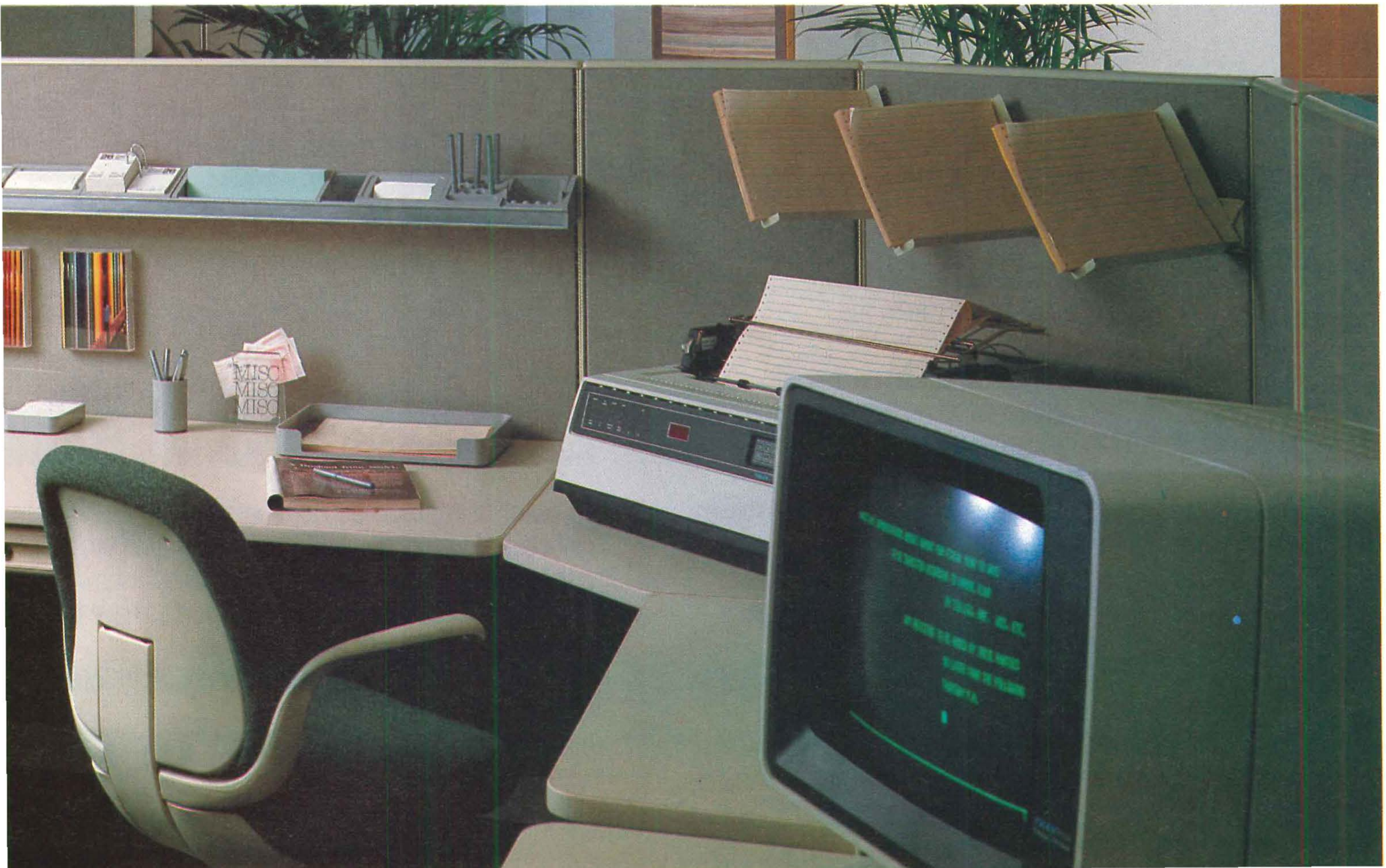

Wood Systems



News report continued from page 42

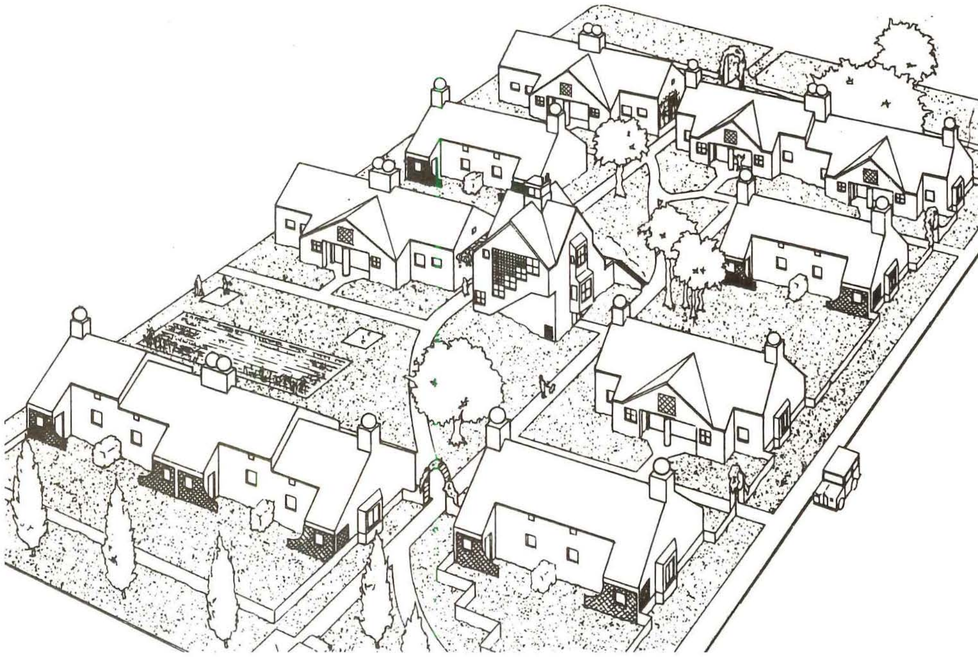
ing direct solar gain in winter and natural ventilation in summer. The gridded doors, skewed both in plan and in section, have a disorienting effect, heightened by the branchlike arms of the clustered timber columns. The regular plan, however, alleviates such conflicting geometries with its evenly spaced bedrooms and studios overlooking the huge fireplace wall in the living room.

Despite the generic problems of entrance and linear organization typical of earth-sheltered buildings, these two houses would seem to be an "unembarrassing" step in the right direction. [TF]

Energy for the elderly

The cost-saving advantages of solar design carry an added significance when applied to housing for the elderly. The units of a senior citizens community designed by Kelbaugh & Lee for Roosevelt, N.J., will require only an estimated $75–$125 for electric heat in the winter (the annual solar savings function is projected at 40 percent) and no air conditioning at all in summer, quite a feat given the New Jersey climate.

Kelbaugh & Lee planned the two-acre farmland site to center on a three-story community building that houses common rooms, a kitchen, lockable storage, and laundry facilities. Eight one-story residential dwellings line up in a stiff site arrangement, their unit plans arranged so that all principal living spaces face south, regardless of which way they front. Each unit is organized around a solarium, a space these occupants may use more than most, backed by a masonry wall. In the summer, rising hot air is guided up a "solar chimney" by rotary ventilators. Operable shades double as night insulation and summer shading; water is solar preheated.



Kelbaugh & Lee: solar bungalows.

The straightforward (and, one hope[s] by now familiar) principles of passiv[e] solar design that organize the units ar[e] cloaked in the picturesque forms o[f] vaguely Voyseyian cottages. Simple an[d] relatively powerful roof forms may hel[p] to compensate for the discrepancy be[-]tween north and south façades, a differ[-]ence that is logical but visually discor[-]dant in most solar housing.

[News report continued on page 50]

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Now a proven system is even better.

Fifteen years of foam panel experience have resulted in the development of Therm-U-Wall — the most advanced factory insulated system on the market today. From conception to production, MOLENCO engineered T-U-W to combine more of the design features architects and owners require:

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Complete line of Accessories. Extrusions with matching Kynar coatings are available for all trim conditions.

With over 65 years of experience in the metal panel industry, who better than MOLENCO to introduce Therm-U-Wall — the latest in flat, foamed-in-place metal panel technology.

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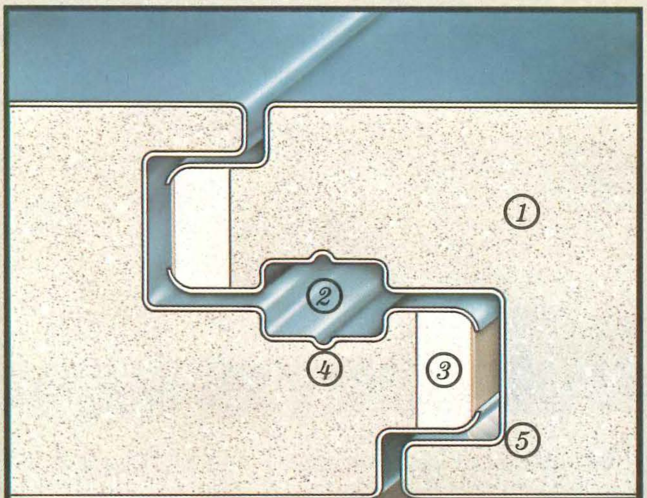

① *2½" of foamed-in-place insulation.*
② *Innovative side joint design allows positive fastening of both skins without clips.*
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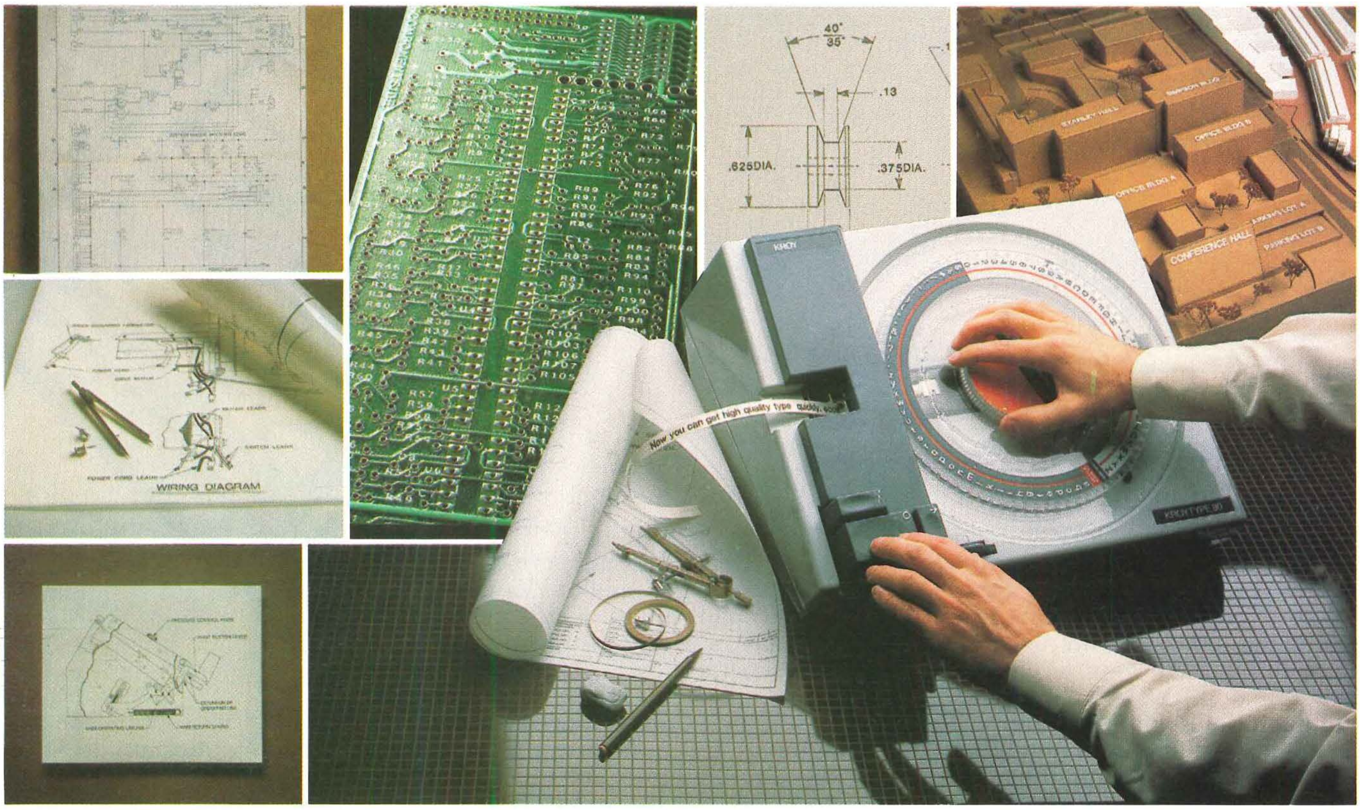

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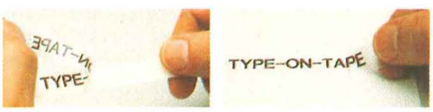

tape from its backing, and it's ready to position in place.

Kroy lettering comes in 25 different typestyles, (including Microgramma and Helvetica), and a wide range of sizes from 8-point to 192-point (1/16 to 2 inches). Typestyles and sizes depend on which Kroy lettering machine model is used.

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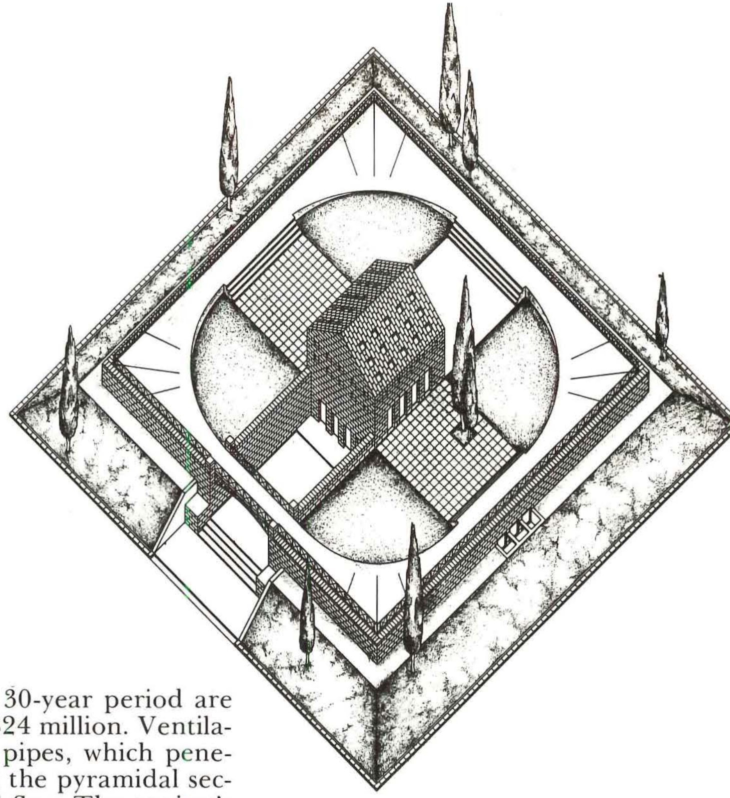
News report continued from page 46



Exploring architectural ideals

Ungers and Kiss: racquet club.

The absence of a specific site for a prototypical Courtside Racquet and Fitness Club designed by architects Ungers and Kiss may account in part for its neoplatonic idealized form. This simple and yet monumental solution buries eight courts beneath an earth berm and organizes programmatic components in a Greek cross plan that recalls the prototypical building types delineated in Durand's *Precis*.

The elegant plan is also energy efficient, and the building's "superinsulation" attributes are likely to prove cost effective. Savings due to energy conservation over a 30-year period are expected to exceed $24 million. Ventilation utilizes cooling pipes, which penetrate the berms, and the pyramidal section acts as a natural flue. The project's program complements these energy-saving measures: Courts require little or no daylighting, and punctures through the insulating enclosures are therefore kept at a minimum. Internal heat sources (lights, people, etc.) supply most of the required heat, while continuous occupancy with no weekend shutdown eliminates the need for Monday morning machinery.

The centralized, templelike pavilion i surrounded by tiled sun decks, exercis areas, and garden quadrants that ex tend and reinforce the absolute, rec tilinear plan. Both "conditioning fac tory" and country club, this project is rigorous exploration of technologica and typological ideals.

[*News report continued on page 54*]

You don't have to go to Alaska to realize the dramatic solar efficiency of Solakleer™ glass. We did, to prove a point.

Wherever heating costs exceed cooling costs, Solakleer's unique low-iron composition demonstrably improves the net energy gain of all windows. When compared to ordinary "clear" double pane, Solakleer transmits 16% more total solar energy—a difference that means a minimum of 25% added heat gain.

For single and multi-family dwellings, as well as low-rise commercial and high-rise residential buildings, Solakleer can deliver fuel heat savings of as much as 33%.† All from a "solar" glass that looks, glazes and costs virtually the same as ordinary "clear."

Turn your building glass products into passive solar products. For prime, replacement or storm windows, as well as insulated units, laminated skylights, greenhouses and patio doors—improve performance for all exposures with Solakleer energy-efficient glass.

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For the name of your nearest Solakleer manufacturer or distributor, or for more performance data, call or write: Tom Milliot, General Glass International Corp., 542 Main St., New Rochelle, NY 10801. (914) 235-5900.

*Comparing ordinary triple glass to Solakleer triple glass for southern exposure †Based on heating season performance, Madison, Wisconsin

Photograph taken atop Murphy's Dome, Fairbanks, Alaska

Look for us in Sweet's Catalog 8.26a-Ger.

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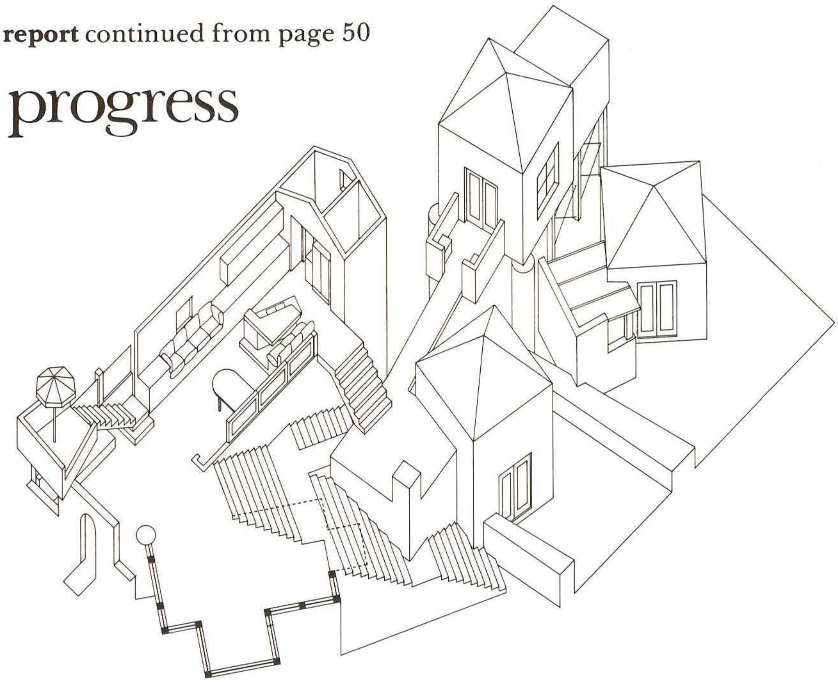
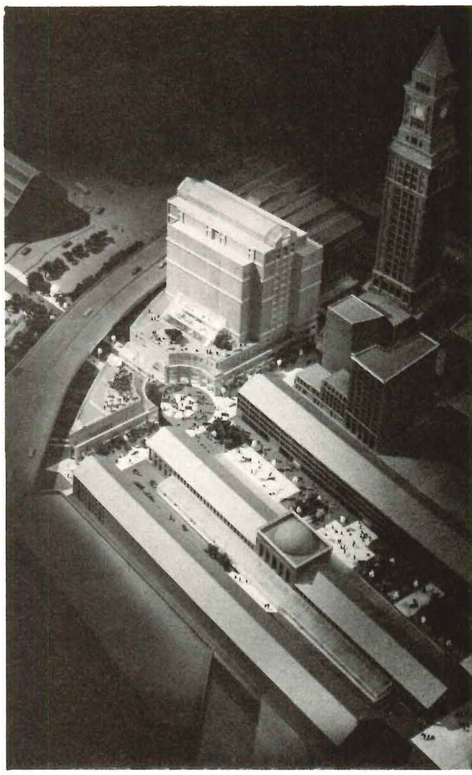
News report continued from page 50

In progress





2

1 The Jaeger Residence, Del Mar, Ca. *Rob Wellington Quigley, San Diego, Ca.* The design problem the architect faced was that of creating a beach house on a site 150 ft from the beach, surrounded by asphalt drives, and separated from the sea by a continuous wall of dwellings. To get in the mood, Quigley imagined a scenario in which a tidal wave washed over an existing structure, scattering its elements over the site. The resulting beach-house-cum-pavilions defines a subtle set of inner relationships and reaches for the sea from the raised portions of the site. Other dualities of beach life—cool wind/hot sun, the quiet retreat/the pounding surf, the beach-bum lifestyle/the elitist location, privacy/sociability—are also addressed.

2 Marketplace Center, Boston, Ma. *Architects: WZMH Group Inc., Boston.* Situated between the commercially successful Faneuil Hall Market Place and the upgraded waterfront, Marketplace Center occupies a key site in the redevelopment of Downtown Boston. The three-story complex, with a 17-story tower along State Street, will contain 350,000 sq ft of office space, 50,000 sq ft c commercial and retail space and a 5000-sq-f Museum of the City of Boston. Facing th Market Place is a shopping arcade wit semicircular plaza. Passing through the sit under a glass-covered canopy, the Walk-to the-Sea continues a pedestrian route fron City Hall to the waterfront.

[*News report continued on page 62*]

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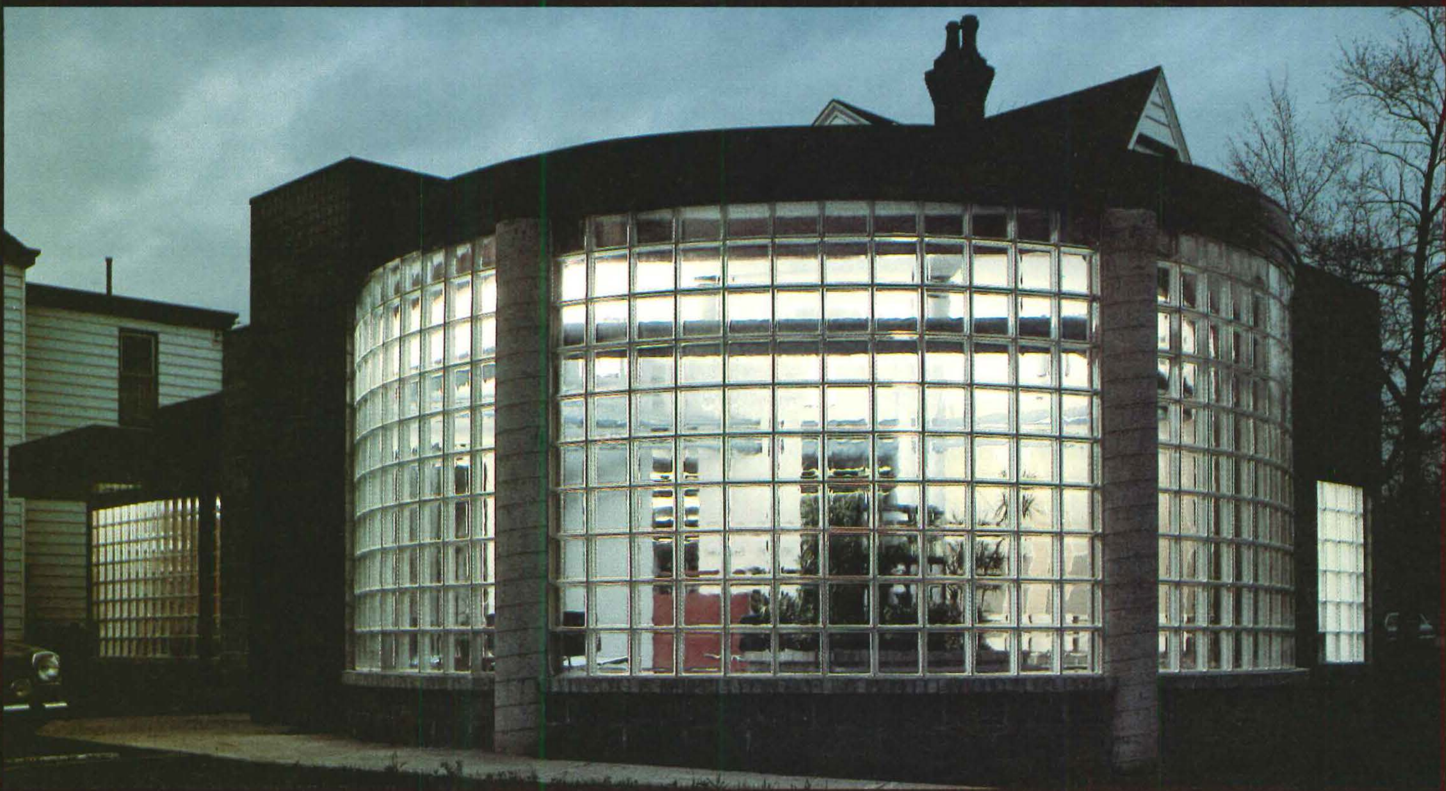

Today, interesting and effective designs are being created with PC GlassBlock™ units from Pittsburgh Corning. PC GlassBlock™ units are used to combine high-tech functionalism and economy with the sensuous appeal of open space and natural illumination. Wide expanses of PC GlassBlock™ panels define space efficiently and attractively. They enclose areas without isolating them, yet maintain privacy.

PC GlassBlock™ units help to control natural light transmission and provide excellent insulating efficiency. By selecting the appropriate pattern or by specifying on-site sand-blasting of the interior surfaces of PC GlassBlock™ windows, an architect can maintain privacy, exploit natural light to the fullest and reduce reliance on artificial illumination. Employing PC GlassBlock™ panels or windows in a new or renovated building can also result in reduced heating and air conditioning requirements and substantial energy savings.

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Sunglas HP Reflective

Our newest high-performance reflective glass can block 80% of the sun's heat and can also reduce conductive heat loss up to 20% compared to normal glazing. Sunglas HP Reflective is available in both high/low reflectance, with a choice of three coatings, four glass substrates and four light transmission options for a wide spectrum of color/performance choices. Sunglas HP Reflective is available in monolithic, insulating glass, spandrel, heat strengthened, tempered and annealed glass. Sunglas HP Reflective is destined to become the high-performance leader in solar control glass.

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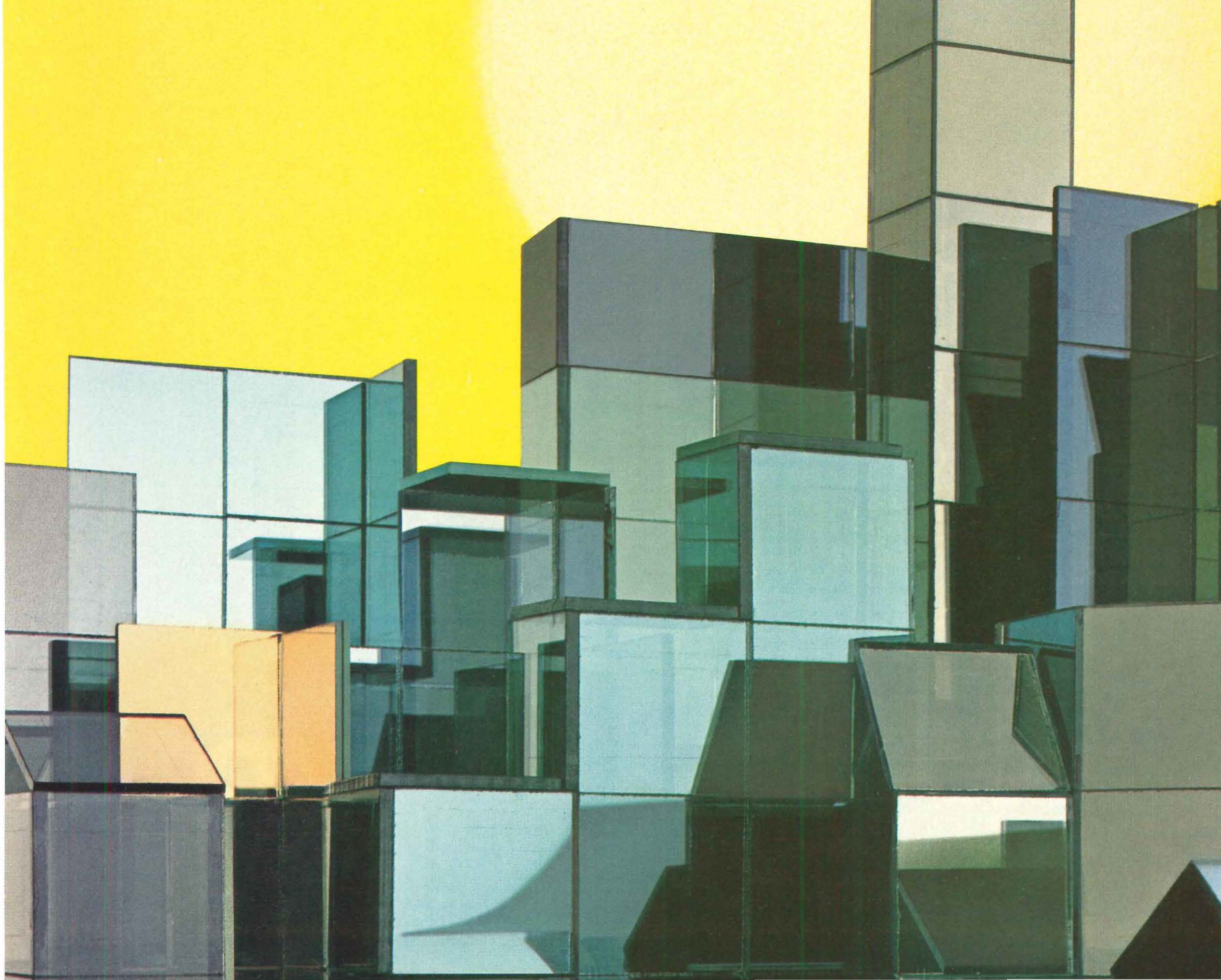

Pencil points continued from page 23

Arts Division with one of three 'Distinguished Designer' awards for 1982. Since 1970, he has lectured at more than 400 colleges, universities, and professional conferences and has taught at the New School for Social Research, Pratt Institute, University of Wisconsin, Cooper Union, Cornell, NYU, and Dartmouth.

New NEA head

New York architect Hugh Hardy has been appointed chairman of the National Endowment for the Arts' 16-member Design Arts Policy Panel.

¶ He succeeds Jaquelin Robertson.

Cover stories

An exhibit held at the AIA headquarters during the month of March featured the 14 architects who have appeared on the cover of Time *between 1923 and 1978.*

¶ The list alone says a lot about public perceptions as shaped by an influential magazine. Tapped for Time *were: Edmund N. Bacon, Ralph Adams Cram, William A. Delano, R. Buckminster Fuller, Wallace K. Harrison, Philip C. Johnson, Le Corbusier, Richard J. Neutra, Nathaniel A. Owings, William L. Pereira, Eero Saarinen, Edward Durell Stone, Minoru Yamasaki, and Frank Lloyd Wright.*

¶ Any guesses as to who might be next?

Election results

Katherine McCoy has been elected to a two-year term as the national president of the Industrial Designers Society of America.

¶ Currently cochairman of the Department of Design at the Cranbrook Academy of Art in Bloomfield Hills, Mich., McCoy is a partner of McCoy & McCoy Associates, consultants in industrial, exhibit, environmental, and graphic design.

¶ McCoy is the youngest person and first woman elected to the IDSA presidency in its 44-year history.

IDEA award competition

The Industrial Designers Society of America is staging a competition for the design of an award symbolizing its annual Industrial Design Excellence Awards (IDEA) program.

¶ IDEAs are awarded to designs in ten categories on the basis of innovative form, use of materials and processes, and benefit to users or manufacturers.

¶ Submissions are due Sept. 6, 1983. For a list of requirements, contact IDSA, 6802 Poplar Pl., Suite 303, McLean, Va. 22101.

Emerging architects

The Architectural League of New York has announced this year's roster of 'Emerging Voices.' The featured architects, selected as much for promise as for performance, will present their work on four successive Tuesday evenings starting April 5.

¶ The series is sponsored again by Krueger and starts off with Thom Mayne and Michael Rotondi of Morphosis, L.A., sharing the podium with Peter Waldman, Houston. The stars of subsequent evenings include David Jones and Guyman Martin of

[*Pencil points continued on page 60*]

Pencil points continued from page 59

Martin & Jones Architects, Washington, D.C.; Anthony Ames, Atlanta; Richard Oliver, New York; Peter Wilson, New York; Ronald Adrian Krueck of Krueck & Olsen, Chicago; Andres Duany and Elizabeth Plater-Zyberk, Coconut Grove, Fla.

Archifête

A 'National Week of Architecture' will be celebrated in Montreal at the end of May. Sponsored by the Province of Quebec and the Order of Architects of Quebec, Archifête, as it is called, will include exhibitions, seminars, tours, and open-to-the public architectural offices.

¶ The seminars will include a colloquium on 'Architecture and Cultural Identity' (a preoccupation in the province) hosted by architectural historian Kenneth Frampton; a discussion on architectural journalism; on energy; and on Art and Building. There will also be a session on architecture for the disabled and the elderly.

¶ A festival of architectural films will be held concurrently.

Sullivan restored

New York-based de Polo/Dunbar, Inc., is developing the general interior design standards and finishes for the Guaranty Building in Downtown Buffalo. Cannon Design, Inc., of Buffalo is acting as restoration specialist, architect, and engineer for the $12.4 million renovation.

Hundertwasser and the box

Rosenthal, the German manufacturer of porcelain and crystal tableware, has commissioned artist F. Hundertwasser to create an environment of 'spontaneous vegetation' on and around its factory in Selb, West Germany.

¶ The factory's harsh concrete façade is receiving a facing of golden mosaics and glazed black and silver ceramic panels, while the roofline is 'coming alive' with birch, ash, and oak trees and hedges.

¶ The aim was to humanize architecture and integrate it with the natural environment.

¶ It was Rosenthal that, 15 years ago, commissioned Walter Gropius to design a factory entered by passing a glass-enclosed tropical garden replete with flamingos.

The Blue Whale spouts

The Pacific Design Center plans to expand, with two new tower buildings placed in the old parking lot. Rather than commissioning Cesar Pelli, who shaped the original 'Blue Whale,' as former partner in charge of design for Gruen Associates, PDC is turning to the Gruen office.

Irish architecture stamps

Ireland is keeping pace with a new philatelic trend to illustrate national architecture.

¶ It has published a new issue of stamps depicting "Irish Architecture through the Ages."

Free natural light brightens merchandise, cuts energy costs for Skydomed® supermarket

Architects and building owners are beginning to see the light – that FREE sunlight can replace or supplement expensive electric lighting, reducing overall operating costs dramatically.

What could make more sense? The fastest way to cut energy costs is to reduce the monthly bill for electricity. And the easiest and most efficient way to do that is to light up the entire area with sunshine, using Wasco Solar Energy Skydomes®.

Moreover, merchandise displayed in natural daylight sells better. Products bathed in sunshine simply have more sales appeal.

The daylighting concept made sense to Safeway management when they built a 48,000 sq. ft. super store in Tempe, Arizona. Wasco Skydomes provide the primary lighting for this installation, allowing the sun itself to control auxiliary flourescent lighting, as needed.

Wasco Solar Energy Skydomes offer lighting and thermal performance so significant that they can now be factored – with computer accuracy – into a total environmental control system for any commercial, industrial or institutional building. Wasco systems prove cost effective in any geographical area of the country both in new construction and in retrofit applications.

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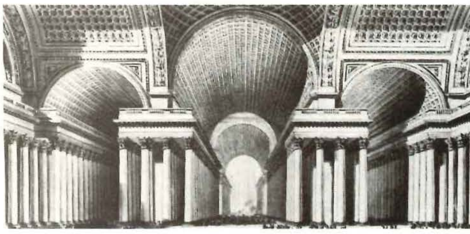
News report continued from page 54

Calendar

Exhibits

Through Apr. 24. Connections: Bridges, Ladders, Ramps, Staircases, Tunnels. Institute of Contemporary Art, Philadelphia.
Through Apr. 30. Landmarks Reviewed. Pensacola Museum of Art, Pensacola, Fla.
Through May 1. New Architecture/Maine Traditions. Joan Whitney Payson Gallery of Art, Westbrook College, Portland, Maine.
Through May 14. French Beaux Arts Drawings by Victor Postolle. Philippe Bonnafont Gallery, San Francisco.
Through May 16. Exhibit Sketches: Le Corbusier's Creative Process. Archicenter, Chicago.
Through May 21. Designs for Theater: Drawings and Prints. Cooper-Hewitt Museum, New York. Also, **Through May 1,** Carnegie Mansion "Embellishments."
Through May 22. Four Villages: Architecture in Nepal. Galleries I & II, Craft and Folk Museums, Los Angeles.
Through May 22. Paul Cret at Texas: Architectural Drawing and the Image of the University in the 1930s. Archer Huntington Art Gallery, University of Texas at Austin.
Through June 15. The Architect's Vision: From Sketch to Final Drawing. Chicago Historical Society, Chicago.
Through June 30. Mondrian: New York Studio Compositions. Museum of Modern Art, New York.



E.L. Boullée, drawing from the RIBA show.

April 21–July 30. Great Drawings from the Royal Institute of British Architects. The Drawing Center, 137 Greene St., New York.
May 15–18. London Furniture Show, Earls Court, London. Also, **May 15–19** Interior Design International, Olympia, London.

Competitions

May 1. Postmark date, ASID/Wilsonart First Annual Design Competition. Contact 1983 ASID/Wilsonart Design Competition, % Ralph Wilson Plastics Co., 919 Third Ave., New York, N.Y. 1002? (212) 753-8686.
May 15. Entry deadline, Vicrtex/ASID design competition. Contact David H Mann, Inc., 666 Third Ave., New York, N.Y. 10017 (212) 867-2720.
July 4. Entry deadline, Olympic Gateway Competition. Contact LA/AIA, 8687 Melrose Ave., Los Angeles, Calif. 90069.
Aug. 12. Entry deadline, First Annual IALD Lighting Awards Program. Contact Stephen W. Lees, Jules G. Horton Lighting Design, Inc., 200 Park Ave. So., Suite 1401, New York, N.Y. 1000? (212) 674-5580.
Sept. 1. Entry deadline, GE Precise Lighting Design Competition (for finished projects). Contact General Electric Co., Specialty Lamp Dept., Nela Park #3372, Cleveland, Ohio 44112.

Conferences, seminars, workshops

Apr. 21–24. American Architecture: Innovation and Tradition. Columbia University, New York. Contact An Kaufman (212) 280-5122.
Apr. 25–27. Lighting World II, exposition and conference. New York Hilton Hotel, New York.
May 18. "Construction Failure—Prevention and Liability," Arbitration Day seminar, New York. Contact Betty Berry, American Arbitration Association, 140 W. 51 St., New York 10020.
May 22–25. AIA 1983 Convention "American Architecture—A Living Heritage," New Orleans.
June 8–10. A/E Systems '83. Market Hall, Dallas. Contact A/E Systems Report, P.O. Box 11316, Newington, Conn. 06111 (203) 666-9487.
June 12–17. 33rd Annual International Design Conference in Aspen: "The Future Isn't What It Used to Be." Contact Lalli and Moore Associates, Inc., 330 W. 42 St., New York, N.Y. 10036 (21 947-6628.
June 14–17. NEOCON 15, Merchandise Mart, Chicago.
June 24–26. Construction Specifications Institute Annual Convention, Kansas City, Mo. Contact CSI, 601 Madison St., Alexandria, Va. 22314 (703) 684-030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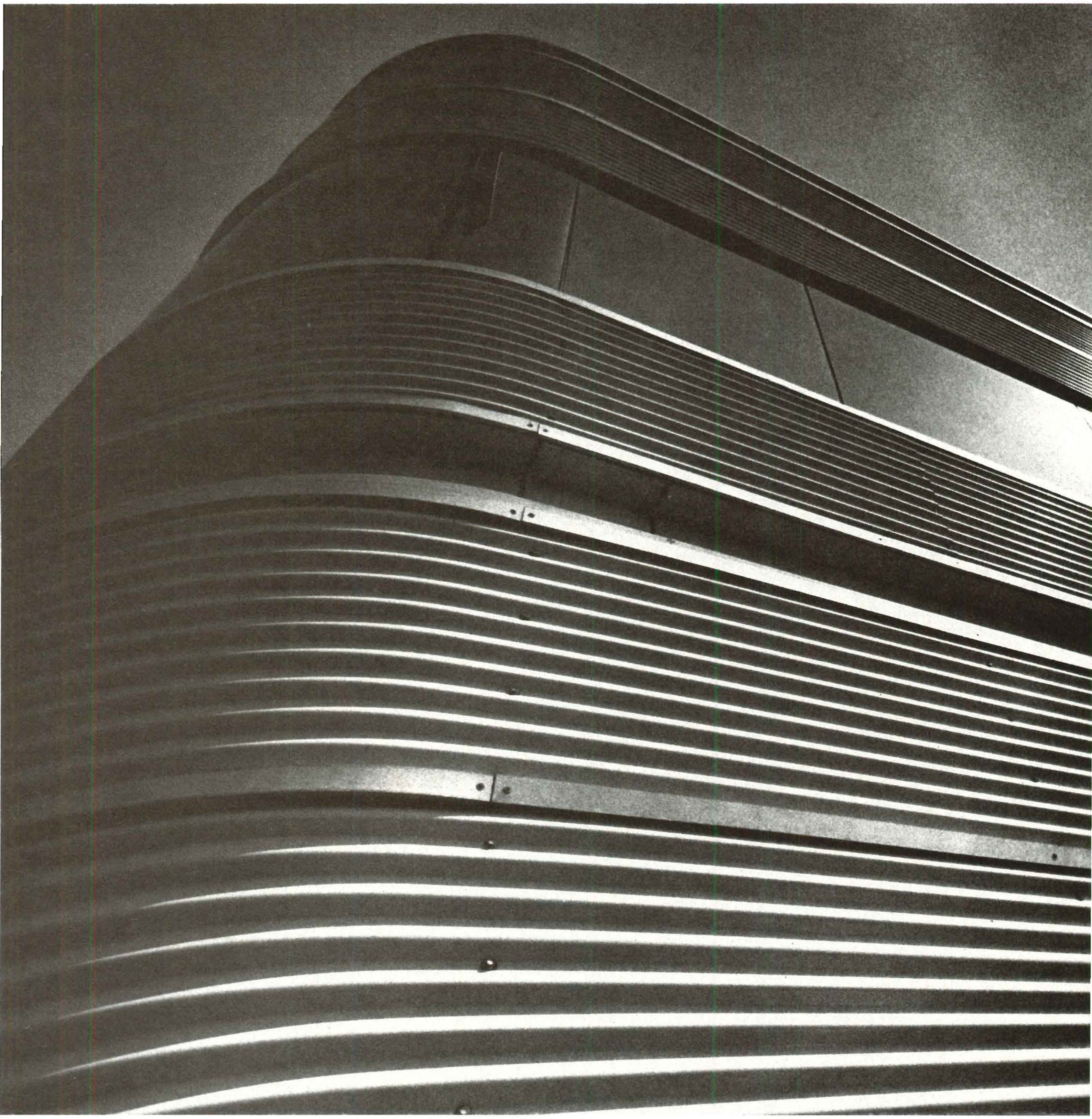

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ıicle Maintenance Facility, L.A. International Airport; Daniel, Mann, Johnson & Mendenhall, architects, Los Angeles.

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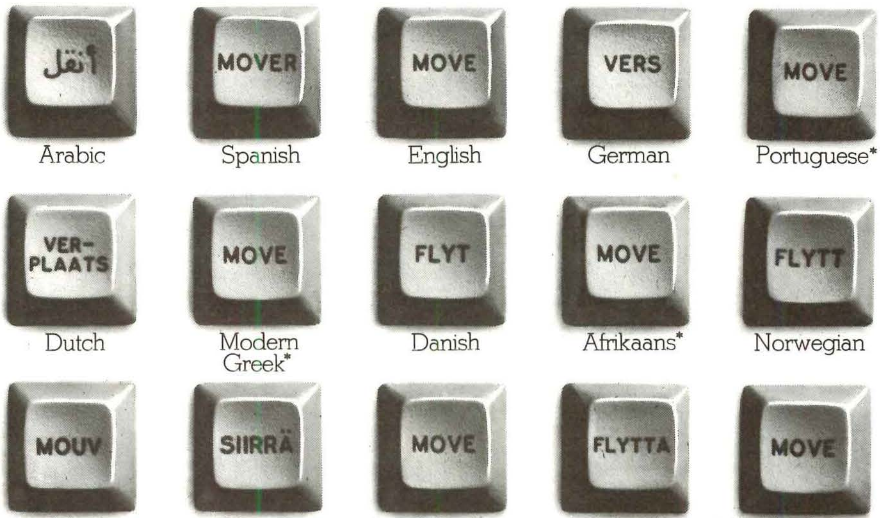

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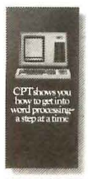

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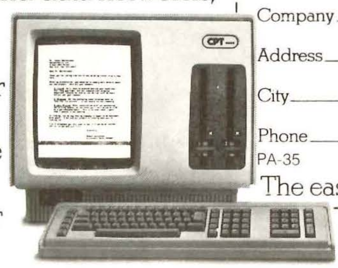

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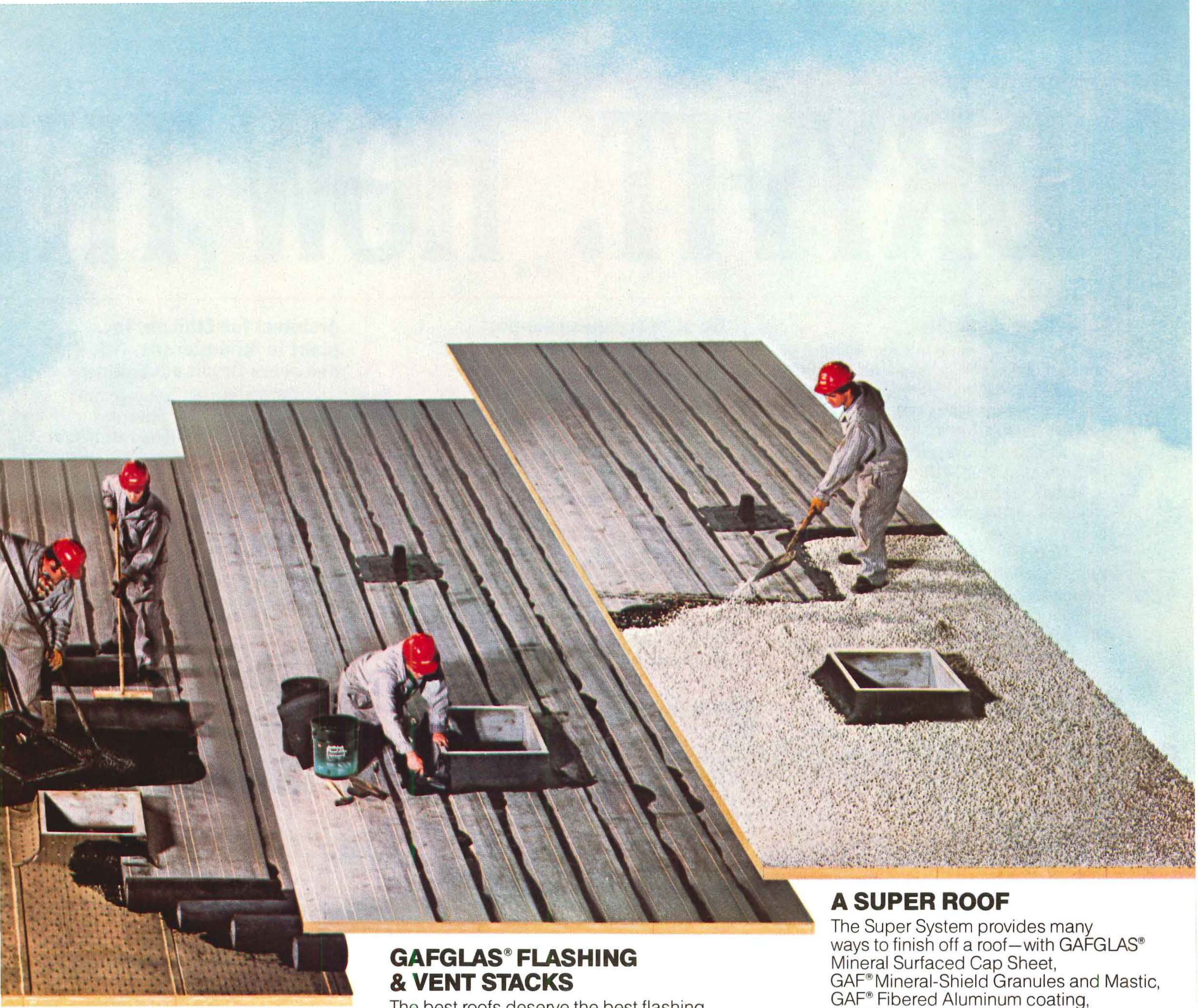

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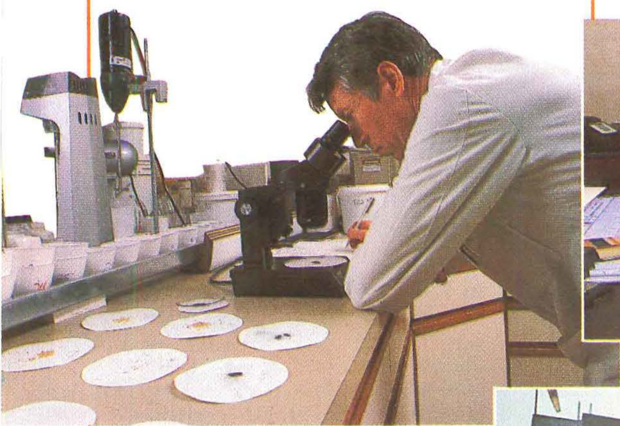

A proven formula goes into our Finish coat and cementitious adhesive.

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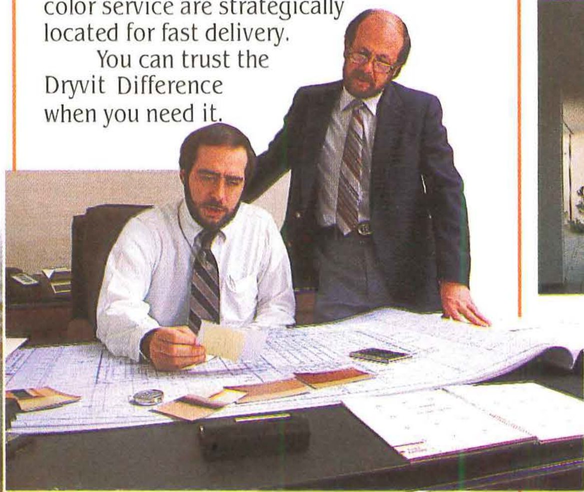

Demanding fire and structural testing go beyond code minimums.

The Dryvit System is recognized by all three model code agencies: ICBO, BOCA, SBCCI.

But we've put our System to even further testing by subjecting it to Full Scale Fire Tests with 1500 and 1250 pound fire sources, as well as the Factory Mutual Corner Test.

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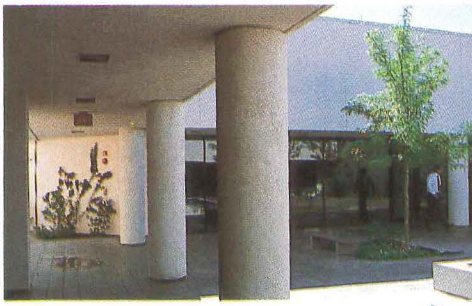
You can have confidence in the performance of Dryvit even under demanding conditions.

Now, read about the Dryvit Difference on these recent projects.

Architect for Ethicon, Inc. plant in Albuquerque, NM, discovers Dryvit advantages.

Tim Norton of Chakos-Zentner-Marcum, architect for Ethicon, Inc., found that Dryvit not only offered structural savings and energy efficiency but something more — a quality of work and support from all the Dryvit people involved. This atrium, only part of the $10 million project, was his introduction to the Dryvit System.



Bay Vista Tower, Seattle, WA, is the tallest Dryvit structure on the West Coast.

It took 900 Outsulation panels in 200 different shapes to cover 100,000 sq. ft. of wall area. The multi-million dollar, mixed use complex contains ground floor retail stores, four floors of offices and 76 luxury condominiums in the five-sided, 18-story tower.

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GUDMUND BERGE, Partner-in-Charge (left)
SCOTT BAUMLER, Project Architect
Mandeville and Berge, Architects and Engineers

We capitalized on our orking knowledge of Dryvit hen designing Bay Vista."

"We used waste heat generated by office ghts and computers to assist in heating the esidential tower. The swimming pool stores his captured heat so it can be used at night. he Dryvit and steel stud panelized system rovided the insulated exterior cavity wall equired for hydronic loop piping. And due to s substantial 3-dimensional flexibility, solved variety of other architectural and passive olar requirements.

The results benefit both the residential nd office users with lower operating costs."

Retrofit with Dryvit turns a lumberyard into a striking office building.

The 281 Office Building in Ft. Collins, CO, (Glaser Associates Architects), has the dynamic look of a contemporary building. Yet this is actually a structure erected in the late twenties.

The System, with Dryvit Insulation Board cut in special shapes, gives a totally new look to the former brick facade.

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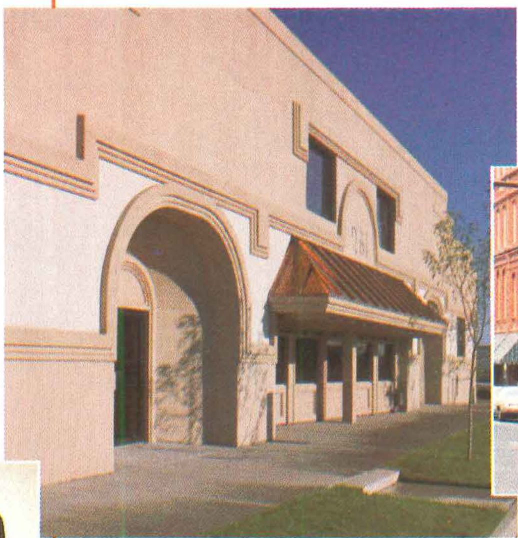

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Yamhill Marketplace: the newest "old" place in Portland, OR.

Architect Richard Ragland of Ragland and Hagerman Partnership turned to the Dryvit System when he had to fit a new building into the 1890 surroundings of the Yamhill Historic District.

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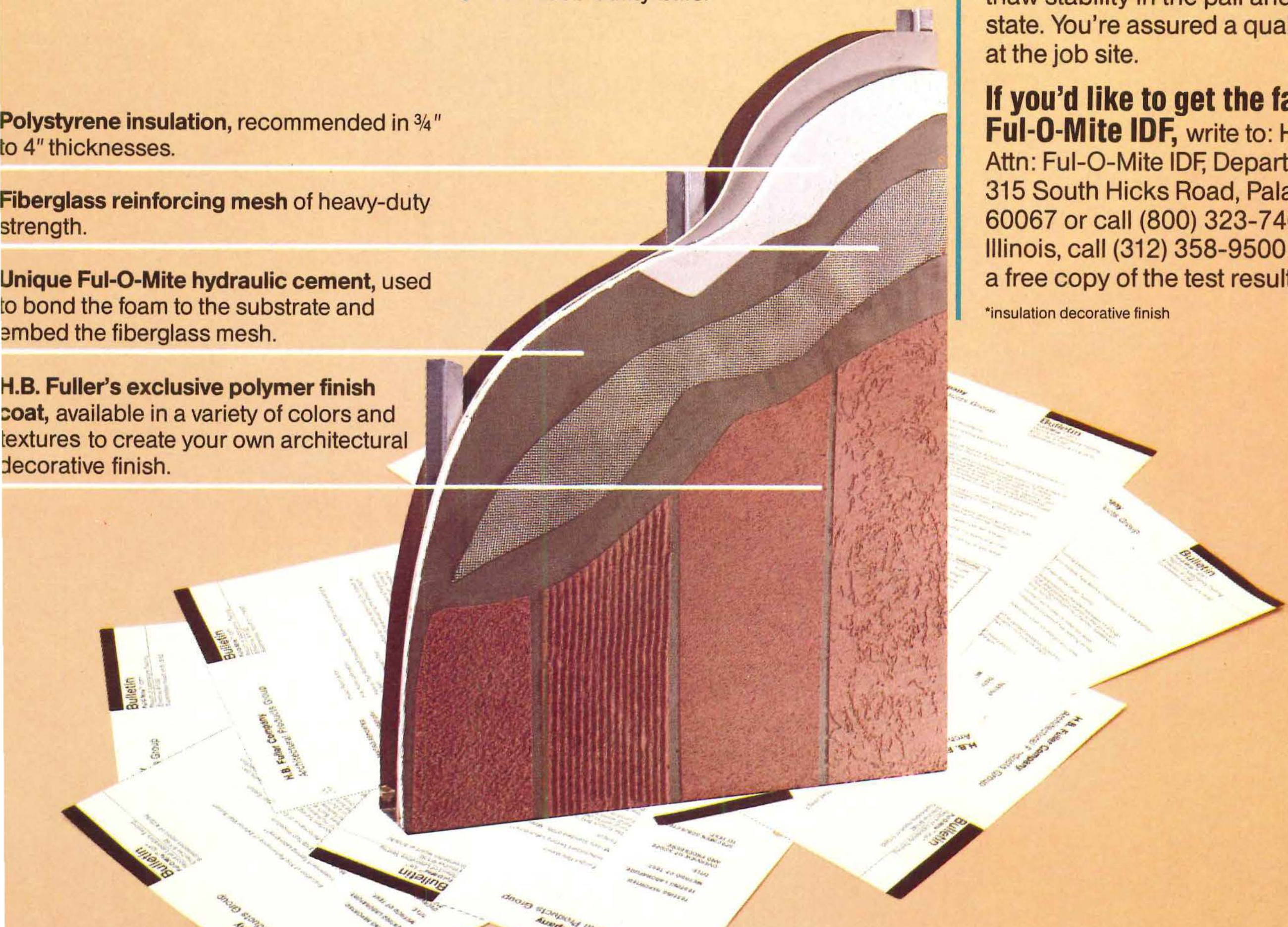

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The energy to conserve

espite, and in some cases ecause of, Federal utbacks, energy-conscious esign has broadened its onservation perspective, xpanded its quantitative rasp, and improved its rchitectural aesthetics. It's n accomplishment worthy f attention.

Conservation is inherent in the design process. If we define conservation not simply as the protection of resources, but as the search for the best and most efficient use of resources, materials, and products, then almost every decision made in the course of designing and detailing a building employs its principle. That may help to explain why conservation pervades current architectural practice, ranging from the obvious conservation of energy and of buildings to the less apparent conservation motive that underlies Post-Modernism—the conservation of historic form.

Thinking of conservation in this way—as a basis for making architectural decisions rather than as just a personal value or a social goal—raises the possibility of unifying what have been isolated aspects of the conservation movement. The conservation of energy and of historic structures, efforts which once seemed incompatible, now seem anything but that in light of research showing how demolition wastes energy and how historic buildings can do a creditable job of saving it. And the conservation of energy, one of the prime generators of architectural form prior to the Modern movement, offers Post-Modernism an economic argument for its aesthetics, if that aesthetic would only better utilize its energy-saving potential.

Those sentiments prompted our expansion of the April "energy" issue to encompass the idea of conservation. The intent is not to diminish the importance of energy conservation, but to explore its broader architectural implications as well as its connection with other conservation efforts. The articles, for example, on the conservation of water, power, and indoor air quality (p. 98) show how energy both affects and is affected by topics as varied as waste disposal, utility rates, and human health.

Energy-conscious design, itself, has begun to take a broader conservation stance. For instance, the California Department of Justice Building (p. 116) addresses the conservation of water; the Trust Pharmacy and Mt. Airy Library (p. 109), the conservation of power; and the Society for the Protection of New Hampshire Forests building (p. 86), the conservation of transportation energy. Energy-conscious design has also broadened its architectural ambitions, tackling unusual programs, as in the Norwegian Dairy (p. 90); large-scale commissions, as in the Hooker Chemical Company's headquarters (p. 82); low budgets, as in the Princeton Professional Park (p. 94); and constricted sites, as in the Pajaro Housing (p. 114).

A broader vision, however, always raises new questions. How will advances in technology—in lighting (p. 127), say, or in a host of other products (p. 167)—affect energy-conscious design? Will they mesh with other passive design strategies, or will they encourage a dependence upon technology to the neglect of architectural solutions to our energy problems? How will the nationwide concern for declining worker productivity affect energy-conscious design? Will energy costs, relatively low when compared with the high square-foot costs of salaries, remain an issue for corporate clients who fear inconveniencing their employees (p. 25)? How will the government's energy policies (p. 24) affect not just short-term funding but long-term training and research? Will programs such as the DOE-funded energy-conscious design series (p. 134) continue under private sponsorship, or will they flounder in an already fragmented building industry? What are the larger political implications of energy-conscious design? Will the conservation of resources on a global scale, discussed in Martin Pawley's *Building For Tomorrow* (reviewed on p. 159), overcome political obstacles that far exceed those architectural in nature?

Whatever its economic or political future, energy-conscious design still faces an aesthetic stigma within the architectural profession. At one time, that prejudice might have been justified, for the development of conservation strategies in the past decade did pre-empt other architectural concerns. Their integration, though, has proceeded rapidly as the energy-conscious community has broadened its aesthetic aspirations and as the larger architectural community has acknowledged energy issues. The projects in this issue reflect that change. They show what conservation, as a basis for architectural decision-making, can accomplish. [Thomas Fisher]

Hooker Office Building,
Niagara Falls, N.Y.

Glass under glass

In a building of Miesian inspiration, the notorious all-glass curtain wall is transformed into an energy-saving double envelope.

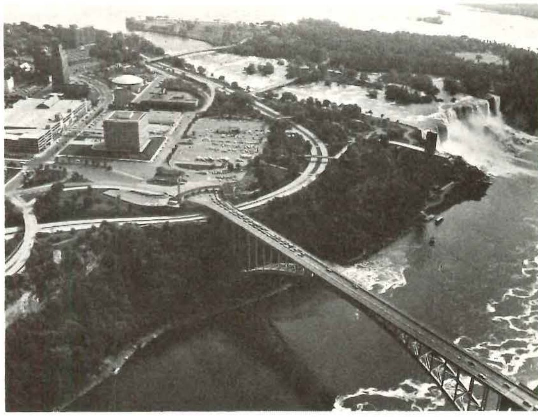
Prominently sited in the urban renewal landscape of Downtown Niagara Falls, the Hooker building has the freestanding Euclidean form and the sleek, ordered surfaces associated with the heyday of Modernism—and with the flood tide of energy consumption. In fact, Hooker is a remarkable adaptation of the Miesian curtain-walled form as a model of energy conservation.

When Cannon Design got this commission, back in 1978, it was clear that Hooker wanted a symbol of its commitment to reviving the core of Niagara Falls. The site was not only highly visible, but offered views of the Niagara River in three directions, so the architects sought an alternative to the constricted window areas then prescribed as a reaction to energy shortages. Assured of unobstructed solar access, they recognized that daylighted interiors offered opportunities for major energy savings, if only heat loss through the glass could be kept low. Pooling their own architecture and engineering skills with the talents of consulting firms (see Data), Cannon came up with a double-envelope scheme.

The key to the design is the 4-foot-wide void between an outer wall of green-tinted insulating glass and an inner wall of clear single glazing. Heat that builds up in this gap under sunny conditions can be vented at the roof. Louvers within the void are adjustable to keep out direct rays; they can be closed entirely at night to keep heat in. Daylight, dispersed by the louvers, provides ample illumination of the outer 15 feet of the office floors—44 percent of their usable area.

P/A's Energy Analysis of the building as designed (April 1980, p. 105) showed Hooker's heating load to be only about 2 percent of that for a "conventional" building of the same volume, and its cooling loads only about 19 percent. These remarkable savings were attributed in part to the virtual elimination of infiltration—a great advantage in this exposed location.

Although calculations were confirmed in full-scale mock-ups, Cannon principal-in-charge Mark Mendell recalls that the double-envelope design demanded courage on the clients' part: "It worked on paper, but there was no real model to show them—and



these were people who would not hav bought a car in its first model year."

One of the operating advantages that coul not be adequately predicted was the move ment of air around the building between th envelope layers. The designers got what the hoped for: Under the most extreme condi tions (sunny, very cold, windy), temperatur in the buffer space varies 10 F from bottom t top; convection currents reach around th corners, holding the temperature differentia between north and south sides to 15 F, a most (i.e., the average temperature betwee envelopes might be 68 F on the south, 53 F o the north).

Energy performance of the building ha been affected significantly by changes in us since the building was programmed (change that also underscored the adaptability of th square, column-free floor layouts). The loca tion here of a major computer installation working around the clock, has doubled th building's demand for power (which is plent ful in Niagara Falls). The spread of the offic day beyond the anticipated eight hours ha increased the use of artificial lighting. Th additional heat generated has eliminated th heating demand altogether; the gas-fire boiler has literally never been used for hea And the louvers are never closed except du ing rare weekends when the computers ar shut down *and* the weather is very cold.

Clean machine

In detailing this energy tour de force, Ca non Design chose a vocabulary of simple cro sections and hidden connections. Even give its minimal form and regular structure, th building could have had more Constructivi detailing, emphasizing structural sectio and connections, perhaps with colors—an a proach illustrated in the nearby Winte

ted on axis of the Rainbow ridge from Canada, the building stands amidst tourist parking ts (aerial photo, opposite) with ews of Niagara River and orge to south, west, and north. n enclosed footbridge leads to a rking garage with indoor links shops, Wintergarden, and tel. Entrance front (this page) ces east, toward other buildgs. Night view reveals louvers d inner glazed wall, only rtly visible by day through ter layer of green glass.

Patricia Layman Bazelon

garden by Cesar Pelli (P/A, Aug. 1978, pp. 72–79). This would have underscored, rather than understated, the building's unconventional concept.

As it is, only the louvers introduce some unaccustomed hardware. These off-the-shelf components, intended to control air in large ducts, span the 15 feet between columns and provide full shade at a vertical spacing of 8 inches, enough of a gap to afford an unobstructed view from close up; their airfoil sections have no aerodynamic use here, but turn out to be excellent for dispersing light. The louver system seems to present little distraction to workers inside, after the first couple of weeks.

The green glass, which transmits 80 percent of visible light, has no noticeable effect on views or indoor colors. From outside, the greenish glass and the white grids on and behind it emphasize the transparency of the envelope: gray or bronze tones would have contrasted with the sky and looked more opaque.

Every aspect of the exterior underlines its regularity and unity. The glazed bridge that connects it to a parking garage is clear and tubular and held away from the main cube to preserve its integrity. The main ground-floor entry (which gets less traffic) has been subtly but effectively marked by carving away th tinted and louvered layers to expose a rectan gle of clear glazing.

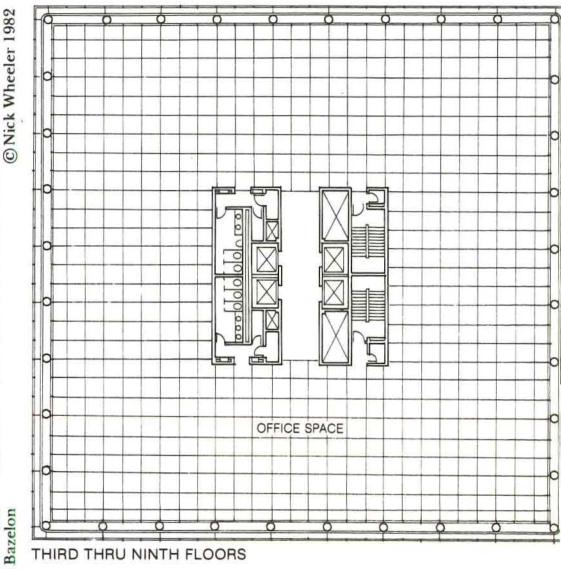
Cannon has put its energy experience t work on other buildings: their Norstar Build ing in Downtown Buffalo, with a less adven turous daylighting concept, has won an OC Award (P/A, Jan. 1983, p. 21). Asked whethe Cannon has considered the double envelop for subsequent projects, Cannon enginee Alan Sloan answers that it is "always unde consideration, but it's not a panacea." Fo double-envelope to work, he explains, yo need special circumstances—all present here an open site, a commercial function, an infiltration as a major factor. Asked about th "payback" period for the double envelope Sloan objects that the *concept* of payback fai to recognize offsetting savings such as, in thi case, cutting the mechanical systems contrac about in half. The building came in for les than the client's original budget, he says. "W paid no premium for the double envelope, s no payback is due."

For now, Hooker remains the landmar application of the double-envelope concep —and serene proof that high energy per formance need not call for unconventiona forms. [John Morris Dixon]

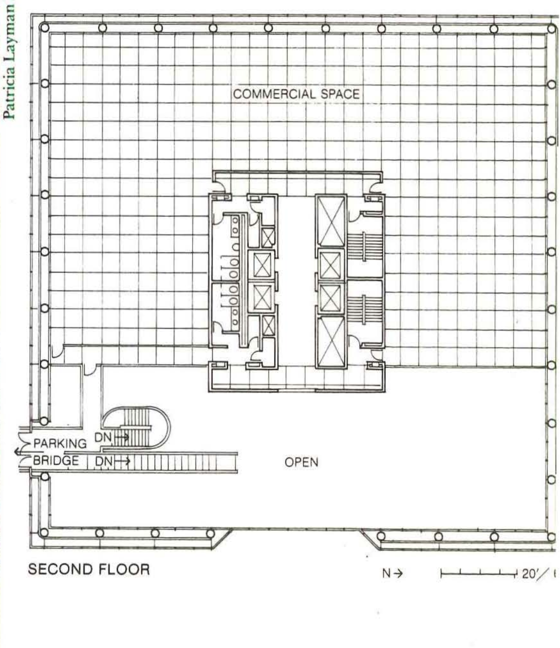
Inside double envelope, louvers eight inches apart control sun; airfoil shapes temper light-dark contrast and diffuse light into offices. Corner office (below) may have louvers at different angles—from horizontal to 45 degrees down, on different exposures. In lobby (bottom), louvers and outer glazing are cut away to leave clear glass around entrance.

©Nick Wheeler 1982

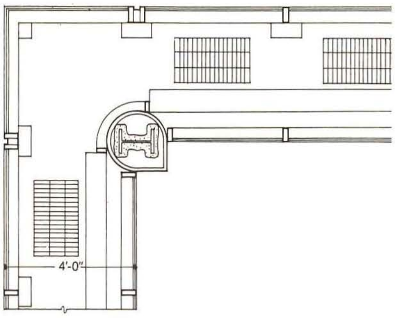
Patricia Layman Bazelon



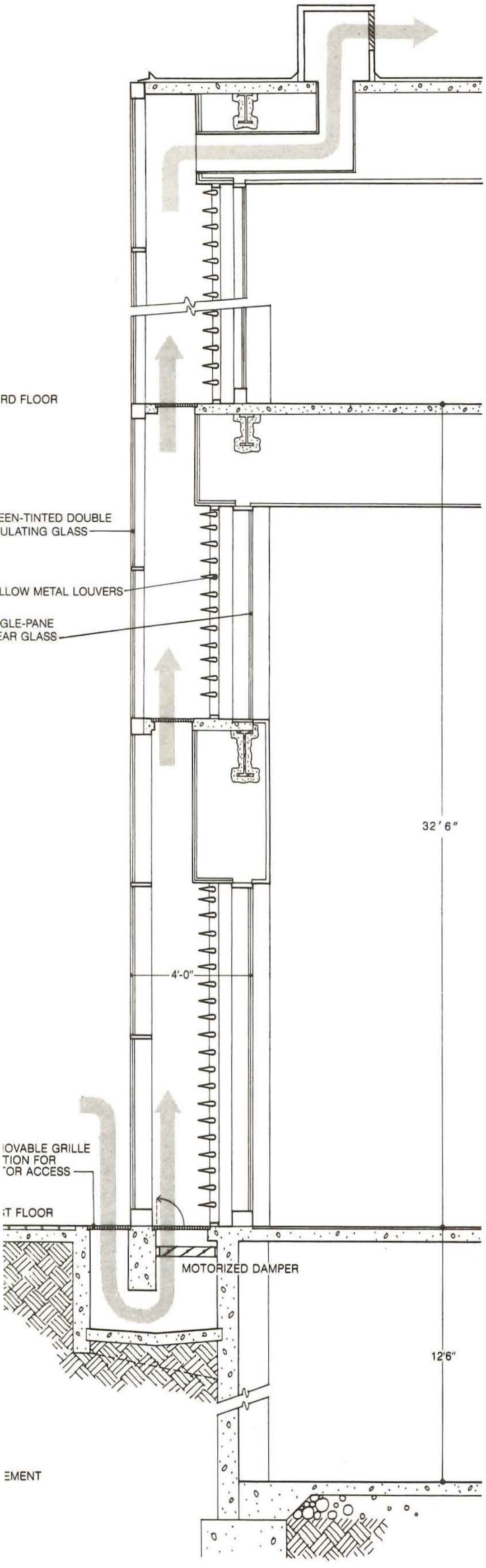
THIRD THRU NINTH FLOORS



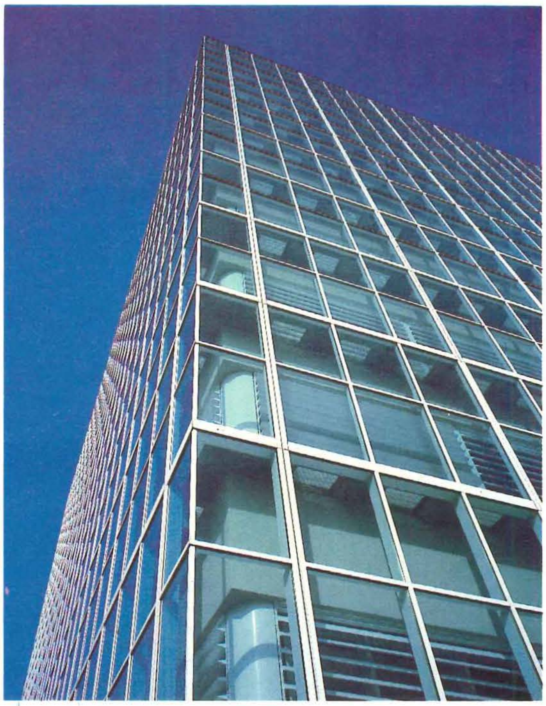
SECOND FLOOR



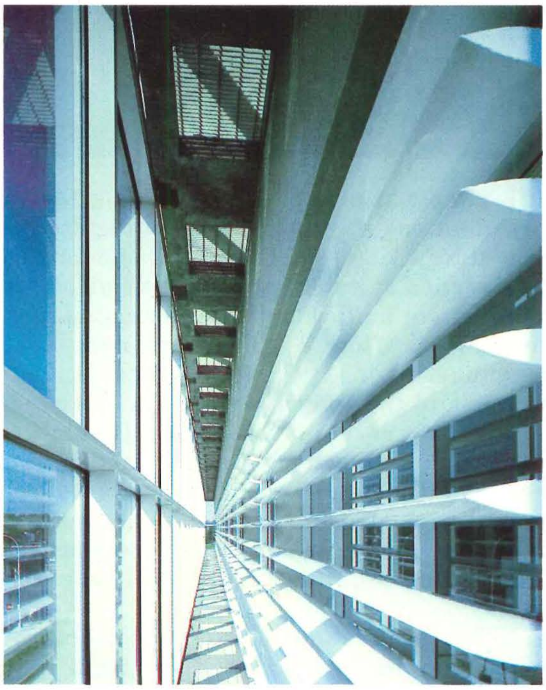
AN AT CORNER



LL SECTION



Patricia Layman Bazelon



Detailing of double envelope involved many subtleties: white aircraft paint on louvers yields best light diffusion and least heat gain; beige carpet in "raceways" (center photo) looks clean and reassuring from inside; light sensors to control tilt of louvers are carefully placed in pairs to discount mullion shadows; delayed response cancels effect of passing clouds.

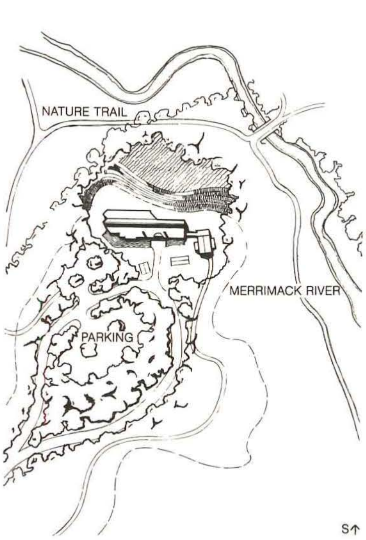
Data

Project: *Hooker Chemical Corporate Office Building, Niagara Falls, N.Y.*
Architects: *Cannon Design, Inc., Grand Island, N.Y.; Mark R. Mendell, principal in charge; Mark R. Mendell, Gautam Shah, Charles Arraiz, Alan Sloan, Jack Foster, Gerald Maslona, Dale Gaff, Douglas Purcell, design team.*
Site: *2.3 acres of open urban renewal land, on axis of bridge linking U.S. and Canada, overlooking Niagara River gorge.*
Program: *corporate offices of 161,150 sq ft plus 41,300 sq ft of commercial and office rental.*
Structural system: *steel frame, metal deck.*
Mechanical system: *electrically driven centrifugal chillers, from which heat is recovered all year; gas-fired boiler; low-pressure variable air volume distribution; all systems (solar shielding, HVAC, fire alarm, security, etc.) integrated through computerized automation system.*
Major materials: *double-envelope tinted and clear glass curtain walls; aluminum louvers; coffered ceiling-lighting systems (see Building materials, p. 176).*
Consultants: *Gillum Colaco, structural; Prof. John Yellott, Prof. Richard Levine, Burt Hill Kosar Rittelman Associates, energy; Bolt, Beranek & Newman, acoustics; William Prentice, Architects, interiors.*
Consulting architects: *Hellmuth, Obata & Kassabaum.*
General contractor: *Siegfried-Scrufari Joint Venture.*
Costs: *$12,500,000 (bid, Jan. 1980), about $62 per sq ft.*
Photos: *Barbara Elliott Martin, except as noted.*

Forest Society, Concord, N.H.

Yankee independence

A demonstration project on several levels, a new office teaches as well as conserves.




Ashton Hallety

It is almost axiomatic that a building for an organization called the Society for the Protection of New Hampshire Forests would have to be designed as a showcase for some ideals, or products, or both. Their new home, designed by Banwell White & Arnold, displays both, with quiet vigor. As C. Stuart White, Jr., said in a talk to the International Solar Architecture Conference in Cannes in December, "You can't get much more elemental than sun and water and earth. . . . We have been removed from elementary considerations in architecture for the last 30 years or so, particularly in the U.S., and it seems time to get back to them."

In this Conservation Center for the Society, White has used wood products from only New England forests, and set out to demonstrate energy-conserving solar design in a convincing way. It was the Society's wish to demonstrate New England capability to provide forest products for the Center, thus saving transportation energy. The glue-laminated beams and columns mark the first commercial use of New England spruce, and diagonal sheathing boards were substituted for the usual plywood—a western product. Further use of wood is in the auxiliary wood-burning boiler, designed to burn wood pellets; it is made in Denmark, as are the aluminum baseboard radiation units.

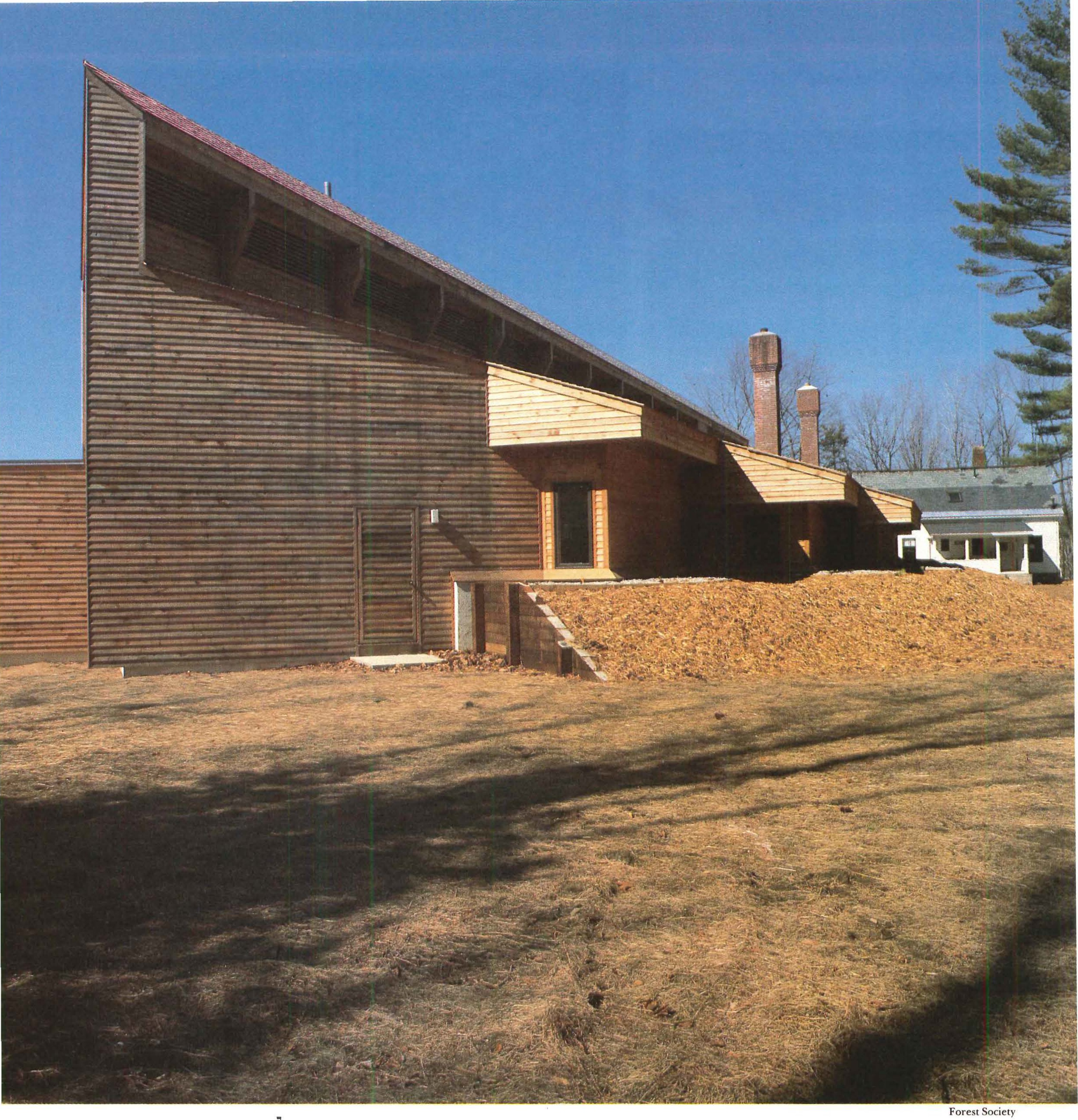
However well it serves to demonstrate the usefulness of New England-grown forest products, the Center excels in the other goal set for it: energy management and conservation. Long and relatively narrow, the building's plan axis is in the east-west direction, sited on a high bluff overlooking Concord and the Merrimack River. The program called for the facility to be about 7000 square feet, with work space for 20, a lecture space, reception and book sale area, and lavatorie It was to be 40–60 percent solar heated, us wood auxiliary heat, and demonstrate energ conservation in design.

Three distinct strategies have been used i the building, manifesting themselves in di ferent plan areas. These are a double-wal convective-loop conference/lecture area, direct-gain reception area, and daylighted o fice space. In the conference space, a south facing sunspace heats the air, and accordin to monitoring by the Brookhaven labs, pro duces a definite flow of warm air around th inner envelope. The monitoring also notes discernable backflow at night, about 22 fpı at most. An additional wood stove provide any needed auxiliary heat, using about a ha cord of wood per year. A double envelop was decided upon here because any direc gain would make the room difficult to use fo showing slides.

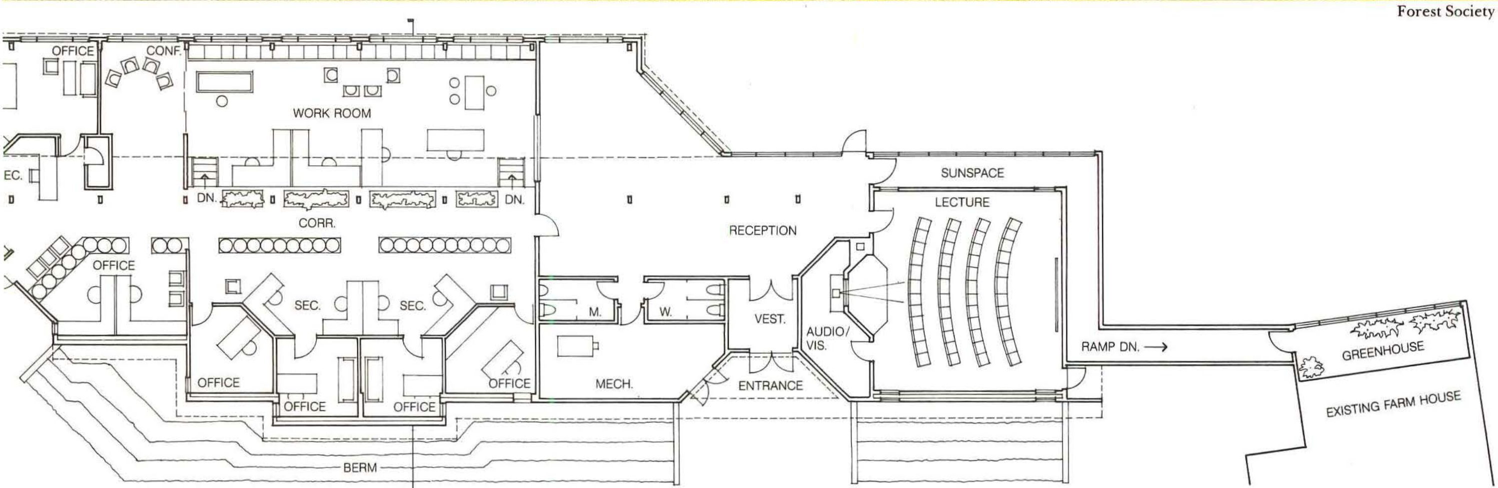
In the adjoining reception area, howeve 489 square feet of south-facing, vertical dou ble glazing allows insolation to be stored i the dark slate and concrete floor and i phase-change materials in the ceiling. Th phase-change materials, or eutectic salts, aı in bags laid into metal deck panels to bette transmit heat stored from direct gain throug high windows. With a low melting point (73 in this case), these materials absorb and stoı heat as they liquefy; when the temperatuı around them drops and they begin to solidif again, they give off the stored heat.

Most active of the areas of the building aı the work room, secretarial areas, and office Here a whole array of solar and other tacti come into play. The two most prominent, vi ually, are actually one form combining tw functions—the roof ridge, with its summe venting louver, and its large aperture vertic clerestory. The vent is obviously for passir off unwanted heat in summer, and the reasc for the large aperture is to get maximu: winter sun penetration deep into the buil ing. The light also gives daylighing to more the building, cutting down on the neede amount of electric light.

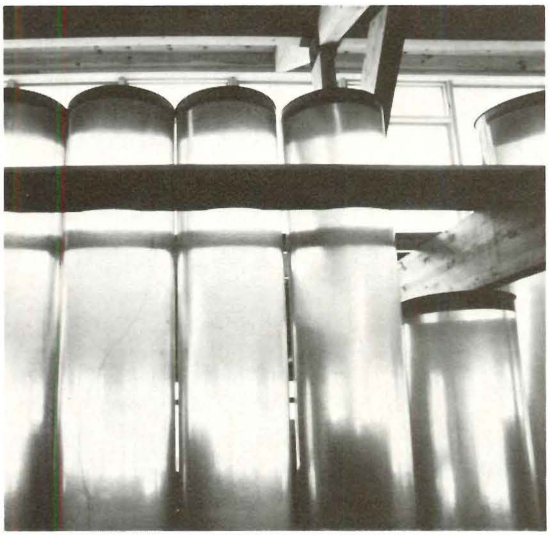
Water-filled translucent fiberglass tub and the back (north) wall receive the mo direct sunshine, through clerestories, with tl tubes diffusing the light to the spaces beyon As with the salts, both the water and the wa surfaces store the heat until called on to r

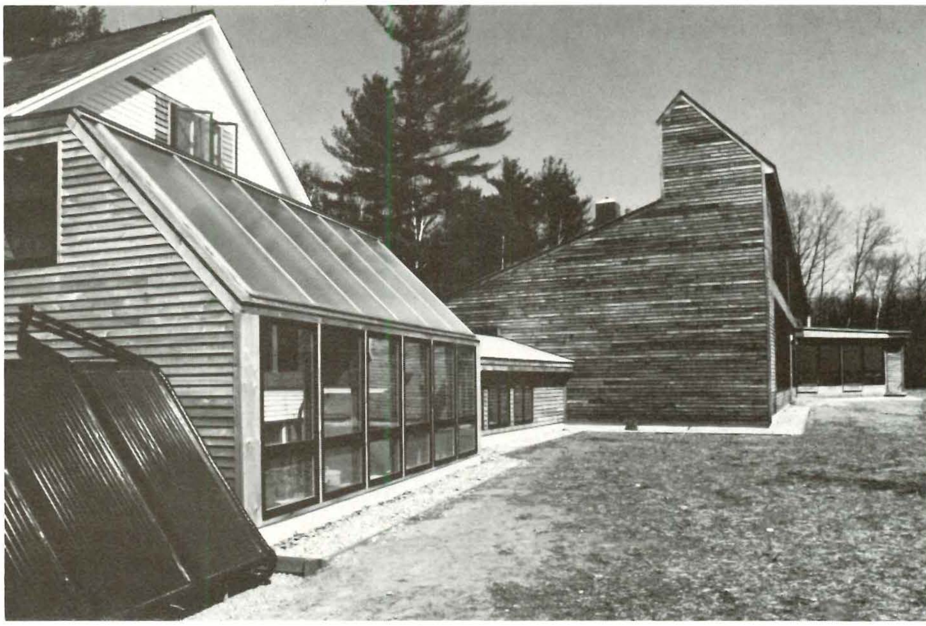


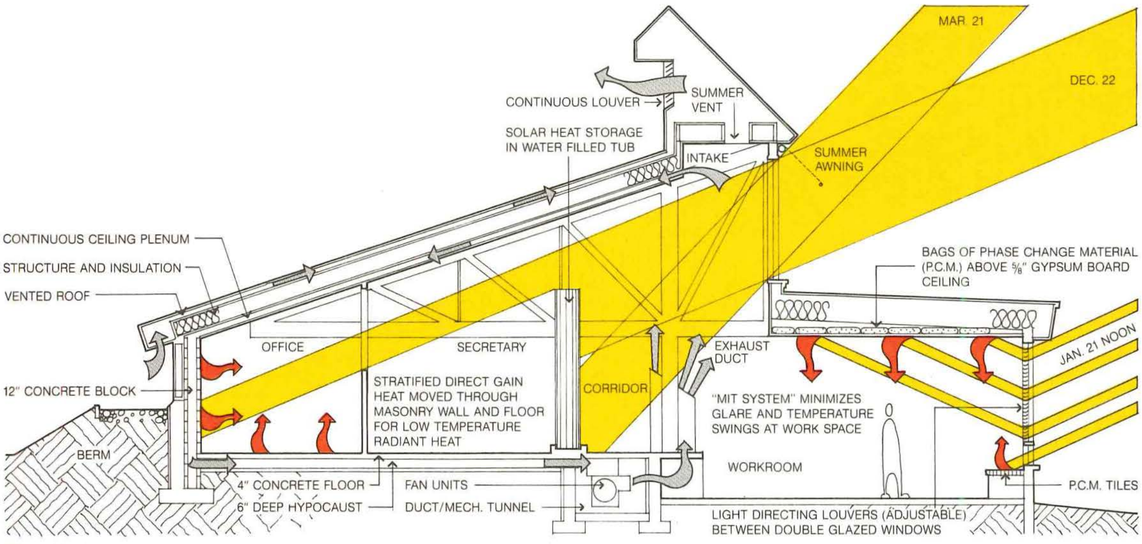
Forest Society



Forest Society, Concord, N.H.

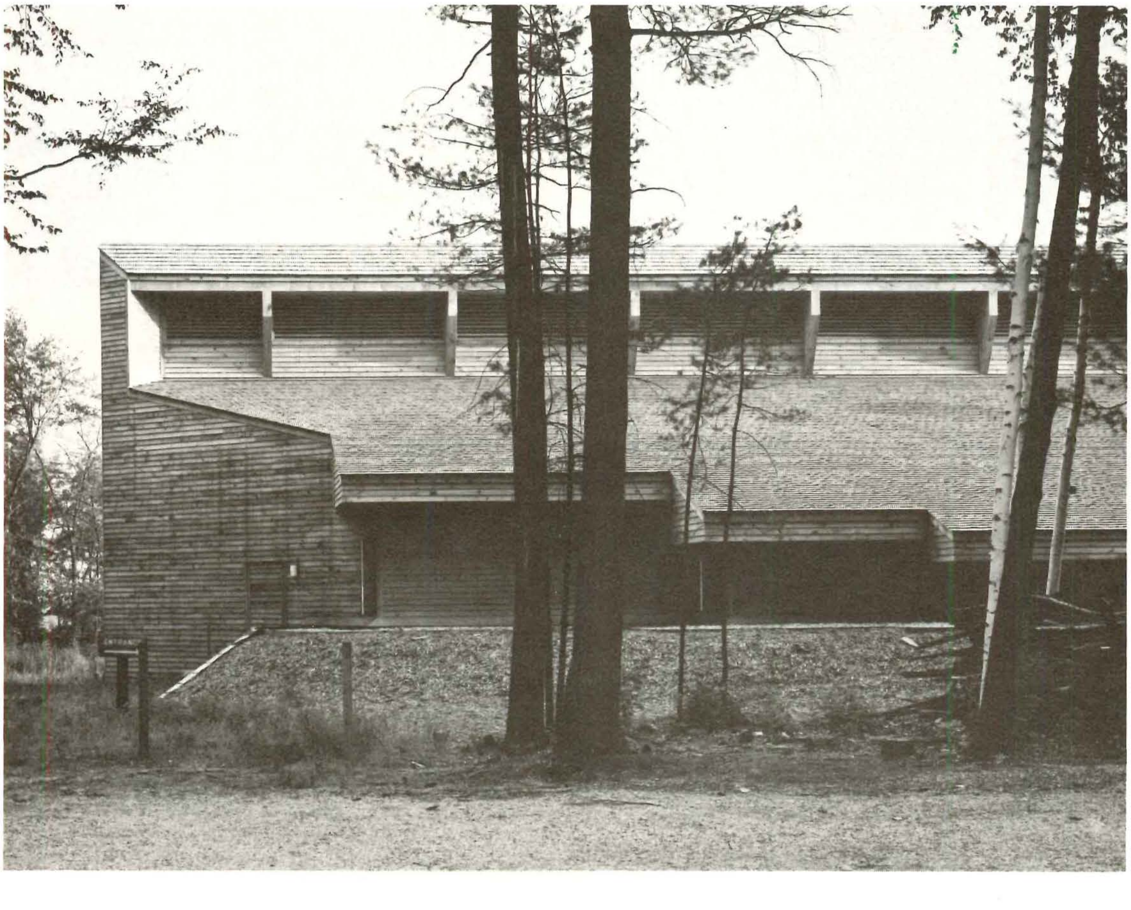




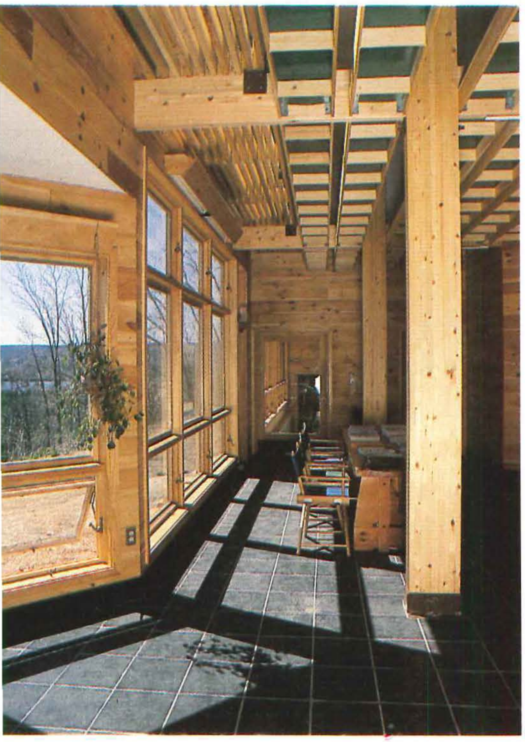


SECTION A

Sloped glazing is used only in the greenhouse attached to an existing, retrofitted farmhouse (above). Large clerestory aperture (facing page, top) is to bring sunlight deeper into the building than would otherwise be the case. Part of the energy is stored in water-filled tubes (top left) or in dark slate and concrete floors (facing page, bottom). The bermed north wall (below left) is topped by a continuous vent for summer circulation.



Robert Gere



diate into the space as it cools. Phase-
ange material is used in the workroom ceil-
g, with some located in sills for direct gain,
.d again above a dark green metal deck; by
eans of reflecting adjustable window louv-
s between double glazing, incoming sun-
;ht is directed up to the deck for later redis-
bution.

Heated air is drawn from the clerestory
/el through an intake, and passed through a
ntinuous ceiling plenum down to and
rough insulated stack bond block walls on the bermed north side. The mortar inside of these block walls has been removed to provide air passage to an 8-inch air space under the floor. Fan units under the corridor draw air out and exhaust it, with its heat removed, toward the clerestory again. In summer, of course, the warm air is vented, and an awning shades the clerestory.

As has been discovered by a number of designers now working with capturing the right amount—and not too much—of the heat from sunlight, one key is to use vertical glass and the sun's natural seasonal angles as a control. Angled glazing only collects its maximum amount in seasons when it is not wanted, with reduced efficiency in cold winter months when the sun is low. White notes that on a clear day in Concord vertical glazing will transmit more than twice as many Btu's in January as in June. Because of its relatively low pitch, the workroom roof has been aluminum coated to reflect light onto clerestory interiors for increased diffused light in work areas and offices.

Night insulating shutters, originally to have been installed at the Center, were not included because of budget considerations. Despite that fact, the building's 48 monitoring sensors report that the facility is exceeding expectations. Even with none of the planned shades, and given the nonautomated data logging procedures, performance is good. It appears to those monitoring the results that the Center is exceeding a 60 percent solar contribution, while using only 23,500 Btu/sq ft/year in auxiliary energy for lighting, heating, and office machines.

Since the original goal for office spaces by BEPS standards was 55,000, the Center has set an impressive track record. And it has done it in a non-muscle-flexing way, creating what appears to be a nice place to inhabit for a workday. [Jim Murphy]

Data

Project: *Conservation Center, Society for the Protection of New Hampshire Forests, Concord, N.H.*

Architect: *Banwell White & Arnold, Hanover, N.H. C. Stuart White, architect in charge, with Peter Lovell.*

Site: *heavily wooded, about 80 acres, on a high, south-facing bluff overlooking Concord and the Merrimack River.*

Program: *offices, reception, and lecture facilities; 7050 sq ft excluding retrofitted farmhouse.*

Structural system: *laminated spruce columns and beams.*

Mechanical system: *passive solar with auxiliary wood-pellet-fired boiler, radiant baseboard distribution, and wood stove.*

Major materials: *wood frame, clapboards, shingles, and floor; slate floor at reception area (see Building materials, p. 176).*

Consultants: *Robert O. Smith, consulting engineer; Paul Goldberg, structural engineer; Richard Heldt, computer analysis.*

General contractor: *Trumbull-Nelson Construction Co.*

Cost: *$540,000 ($76.60 per sq ft).*

Photography: *Robert Perron, except as noted.*

Solar dairy

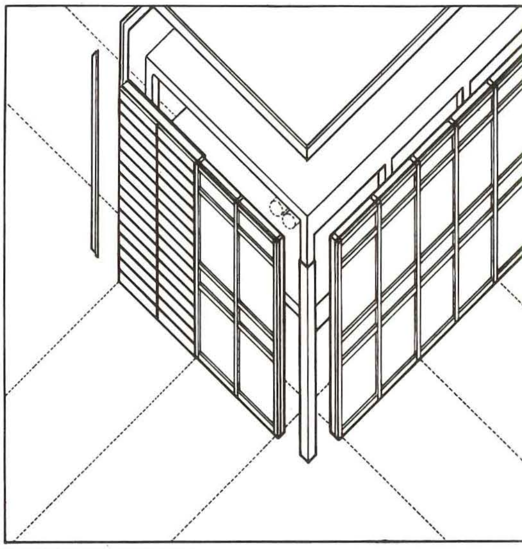
In Norway, standard building components have been used for a solar heating system in a facility for milk processing and dairy offices, and the system has proven competitive with the region's low hydroelectric power costs.

The south side of the dairy (above) faces a public area. Immediately behind the low-emissivity glass walls is the main circulation spine, which is equipped with absorbing/reflecting Venetian blinds, and doubles as the solar system zone. The main entrance is at the west side (facing page) next to the mechanical room.

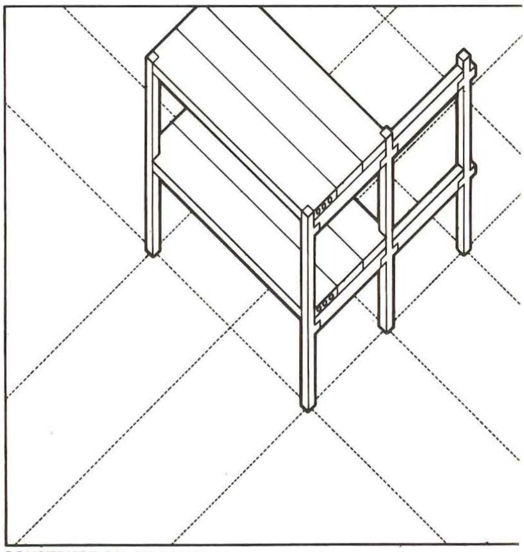
In a region where the climate is similar to that of Juneau, Alaska, architect Dag Borgen of Meierienes Bygnings Kontor has used standard building systems for a cost-effective solar system. In the 14,000-square-foot milk processing plant and offices for Indre Østfold Meieri, the client wanted the building's functions exposed to a public area to its south. For the architect, the major problem was how to combine an entirely open south elevation with low energy consumption, and how to make the result competitive with low-cost hydroelectric power of the area.

By integrating the solar heating system components into the building's volume and normal functions, Borgen reports, the building itself could carry most of the solar investment costs. And by designing the collector as a "climate-responsive and transparent-variable" south wall, its thermal performance would respond according to changes in the heat demand within the facility.

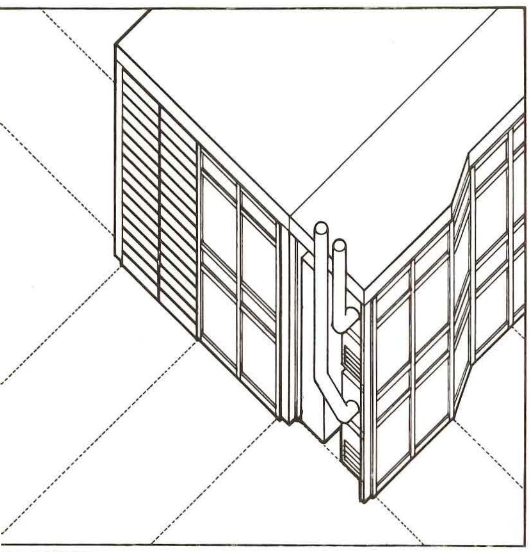
The building is constructed of reinforced concrete frame with precast perforated (for air distribution) floor slabs. It is enclosed with panels of low-emissivity glass, and mineral wool-insulated stainless steel. The major elements of the solar system zone, which runs across the two-story south façade of the building, are a series of absorbing/reflecting Venetian blinds at each level of the building between two double-glazed curtain walls. The air ducts within the zone are linked to a standard HVAC system at one end, and to an isolated ground-level salt hydrate heat storage unit at the other. The blinds are of the standard external type that are reflective on one side and absorptive on the other, thus making it possible to vary the amount of



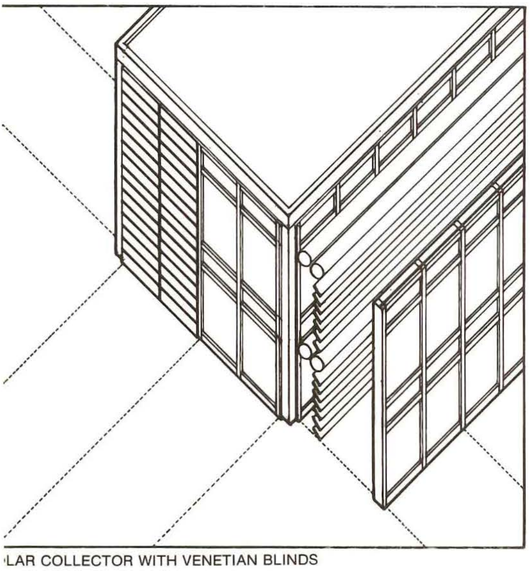
ELEVATION OF CURTAIN WALLS



CONSTRUCTION OF CONCRETE ELEMENTS

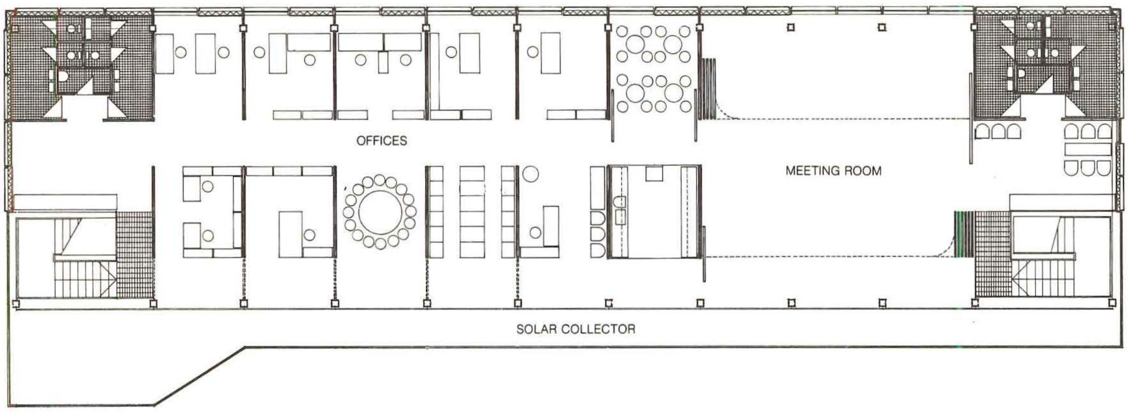


'AC CENTER

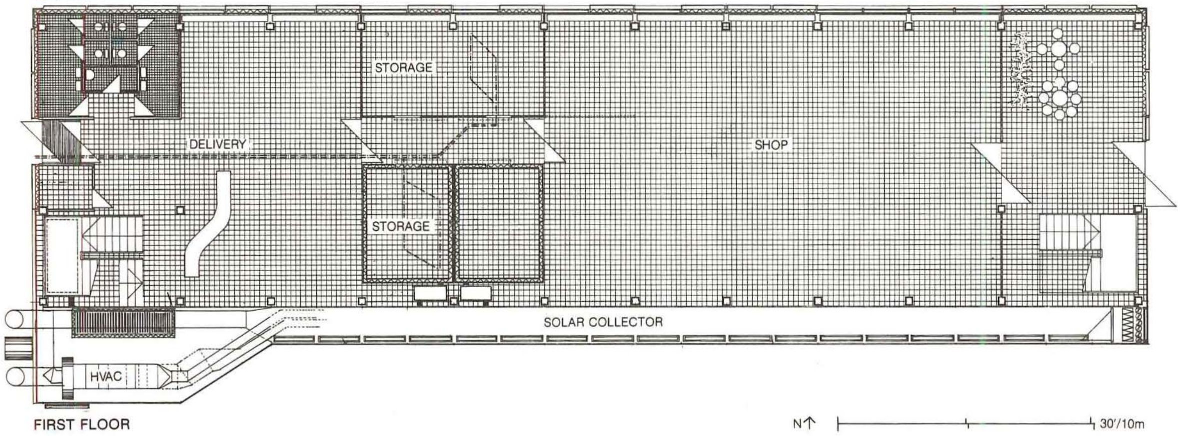


·LAR COLLECTOR WITH VENETIAN BLINDS

Solar Dairy, Oslo, Norway



SECOND FLOOR

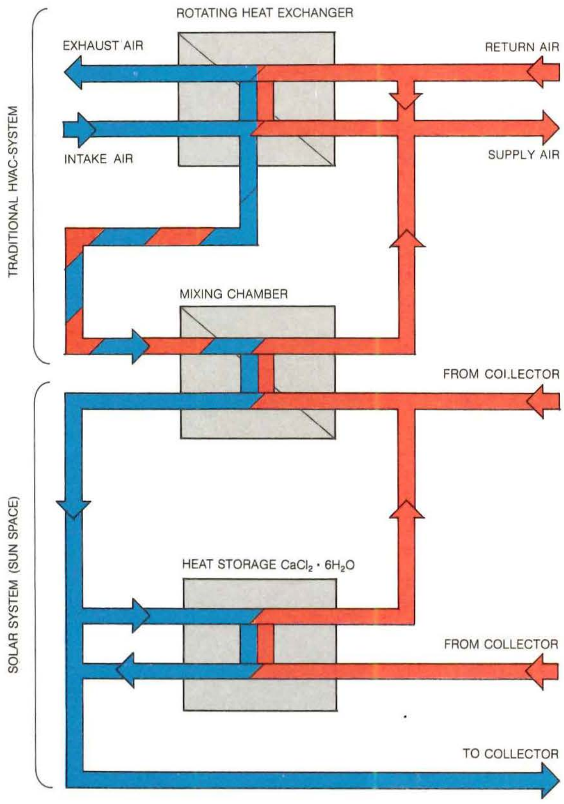


FIRST FLOOR

transmitted, absorbed, and reflected light at the south side. As a consequence, the collector can be operated at optimum adjustments to variations in radiation intensity, inside heat, and light and heat-storage demand. This translates into a system for isolated/direct gain, for preheating of ventilation air, for night insulation and summer shading.

Thanks to the salt hydrate crystals' melting point of 80 F, the operational temperature of the system remains low, with temperatures within the solar collector zone rising to a maximum of only 88 F for efficient use. This means that the solar zone can also be used for purposes other than its primary function, and particularly that it could be used for pedestrian circulation. It is not being used in that manner yet, but it is designed for it and will be so used depending upon climate measurements of the building. At present, the solar zone is used as a "technical vertical ceiling" for the HVAC system, in which the main ducts are connected to secondary ducts within the perforated concrete floor slabs, for air distribution throughout the building.

Although about 60 percent of the heat demand is currently met by hydroelectric power, computer simulations indicate that the building will consume 25 percent less auxiliary energy than a similar building with a 10 percent window-area-to-floor-area ratio, with three layers of glazing, and 8-inch-thick mineral wool walls and roof. Time will tell. If all works out as planned, the building will not only be highly energy efficient, but also an all-too-rare proof that energy efficiency can, in fact, be combined with high formal design. [David Morton]

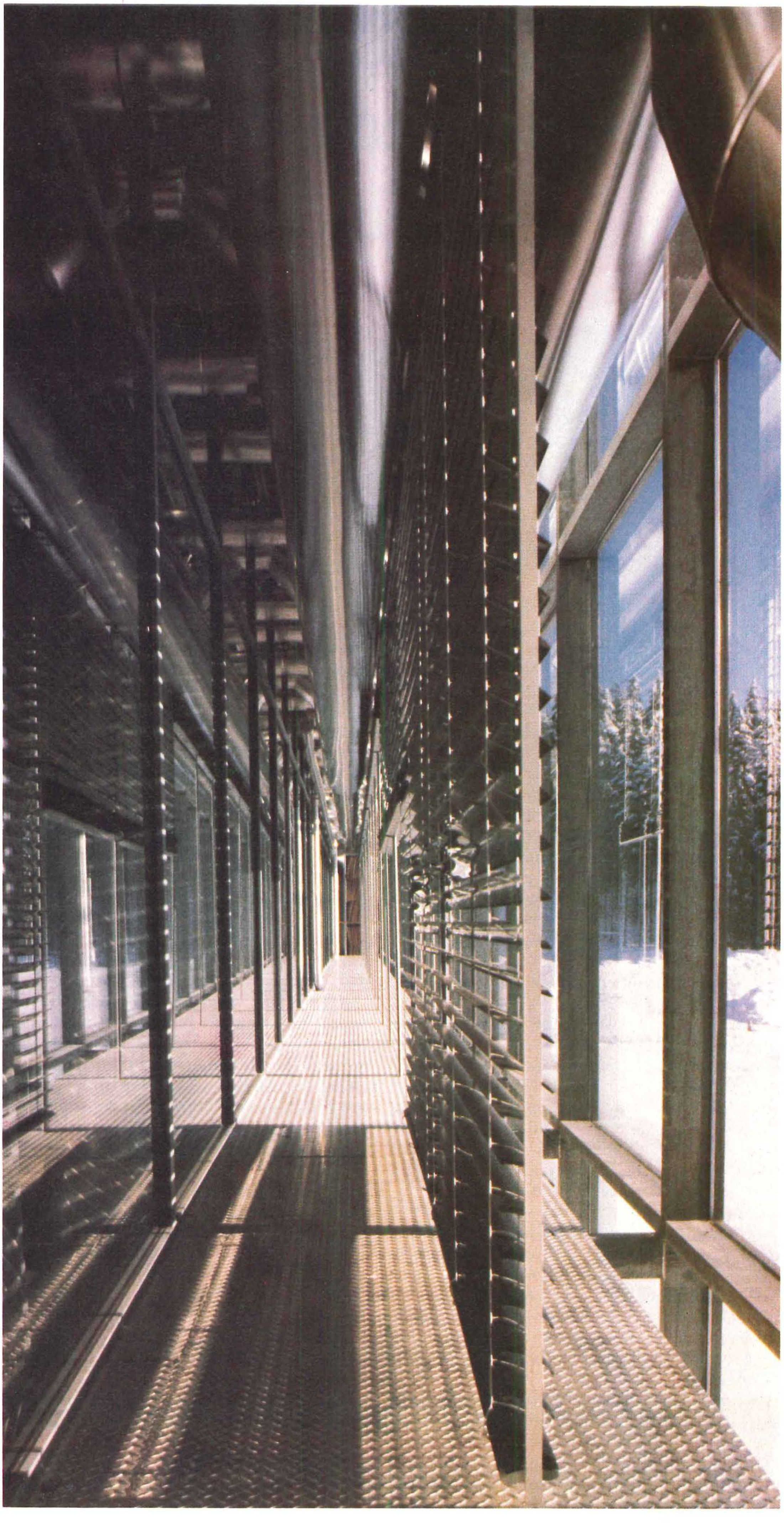


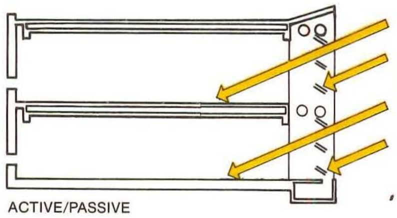
INTEGRATION OF HVAC AND SUNSPACE/SOLAR SYSTEMS

Data

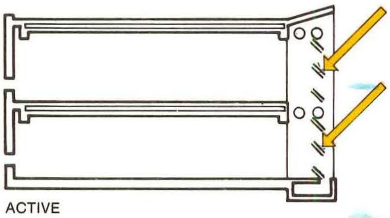
Project: *Indre Østfold Meieri (dairy service building), Mysen, near Oslo, Norway.*
Architects: *Meierienes Bygnings Kontor—Dag Borgen, in cooperation with G.A.S.A.—Per Monsen and Espen Dahl, Oslo, Norway.*
Client: *Indre Østfold Meieri.*
Site: *a flat, open area surrounded by trees.*
Program: *14,000 sq ft of office and milk processing areas for a dairy.*
Structural system: *reinforced precast heavy concrete frame, precast perforated floor slabs, concrete slab on grade.*
Mechanical system: *60 percent of heat from hydroelectric power, 40 percent from solar energy; primary distribution system by air ducts transporting hot air from solar collector, salt hydrate storage, or heating batteries to each room via channels in concrete floor slabs.*
Major materials: *stainless steel and glass curtain wall, 8-in.-thick mineral wool panels, ceramic tile flooring, stainless steel pipe railing.*
Consultants: *Kristoffer Apeland, structural; Lars Myhre, HVAC; Kåre Nybø.*
General contractor: *F. Selmer.*
Costs: *$1,266,200; $94.14 per sq ft.*

The air ducts within the solar zone (facing page) are linked to standard HVAC system at one end, and to an isolated salt-hydrate storage unit at the other (see plan, above, and diagram, left).

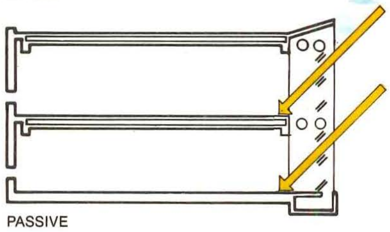




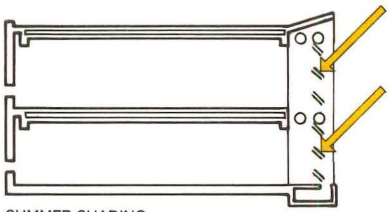
ACTIVE/PASSIVE



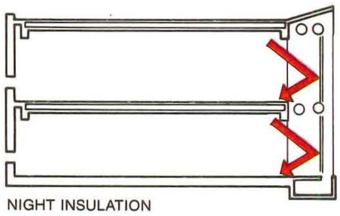
ACTIVE



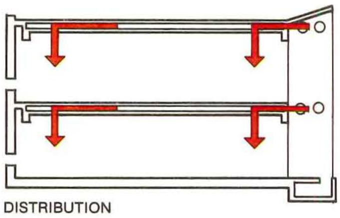
PASSIVE



SUMMER SHADING



NIGHT INSULATION



DISTRIBUTION

Princeton Professional Park, Princeton, N.J.

The decorated climate-filtering shed

Almost every surface of this professional office complex works to conserve and adapt natural energy, producing a quick payback on the investment for energy features as well as a very pleasant environment.

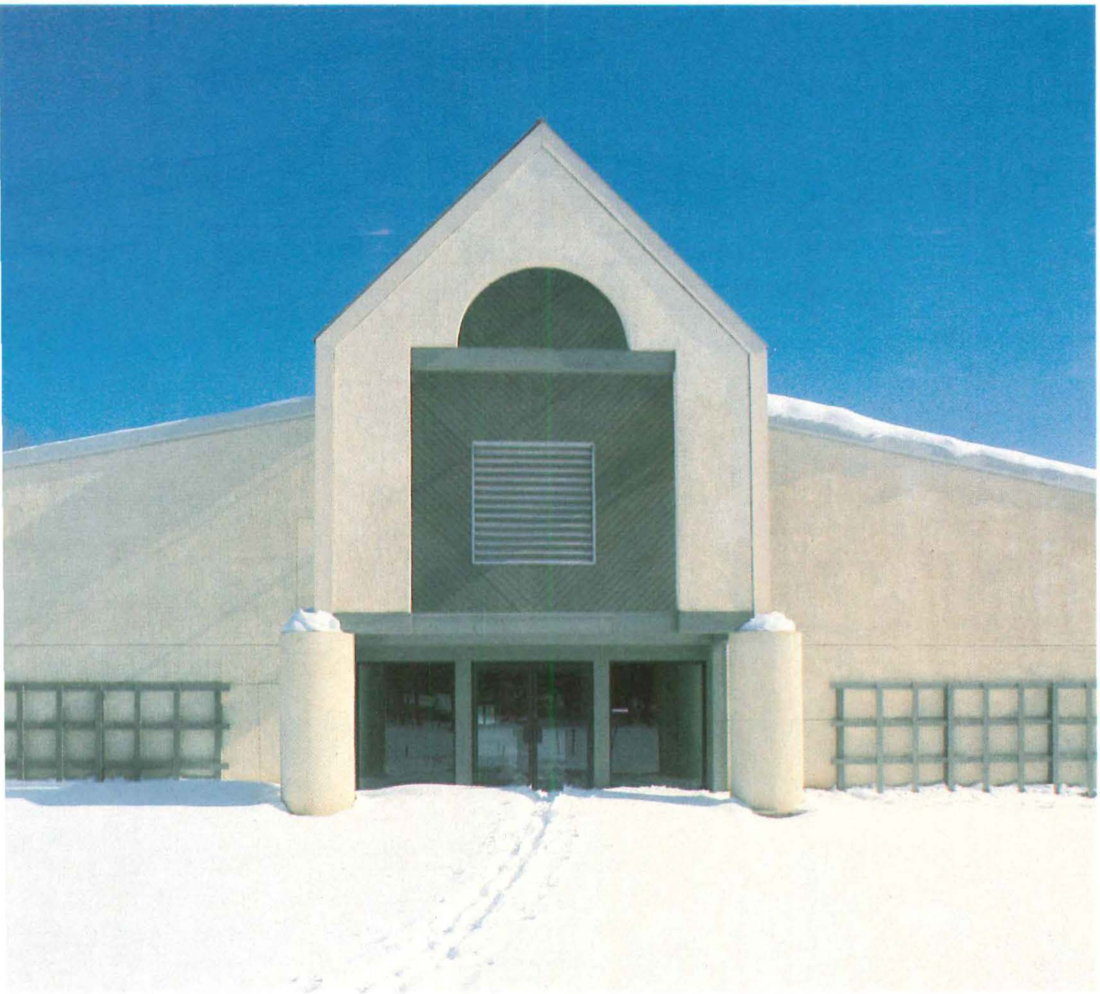
"The most important influence on energy design decisions for Princeton Professional Park," say architect Harrison Fraker and the Princeton Energy Group, "was the principle of using the building form and envelope as a dynamic filter between climate and the natural provision of comfort." The recently completed project, honored in the Fifth National Passive Conference in 1980, employs atriums for passive solar gain, ventilation, and daylight; it uses an evaporative roof-spraying system not only for daytime heat rejection, but also for nighttime production of storable cool air; and it has an underslab rockbed, which the architects claim to be the largest of its sort in the world. To optimize the efficient interaction of the hybrid passive cooling and solar heating systems and the backup electric heat pumps, a microcomputer controller is used.

The architects were not given a lavish budget to construct this 64,000-square-foot office complex; quite the contrary. The client was willing to spend only $37 per square foot—the low end of commercial building quality—and would accept an add-on cost for solar design if it would show a full return in energy saving within five years. For financial and energy economy, the architects developed a profile with two single-story 45-foot-wide sheds sloping upwards to a central double-acrylic-covered atrium. Each shed is made up of 8-foot-wide, plywood-faced, prefabricated structural wood panels spanned by 36-inch-deep wood trusses—an extremely simple structural system to assemble. The basic rental module is 24 feet wide, or 1100 square feet.

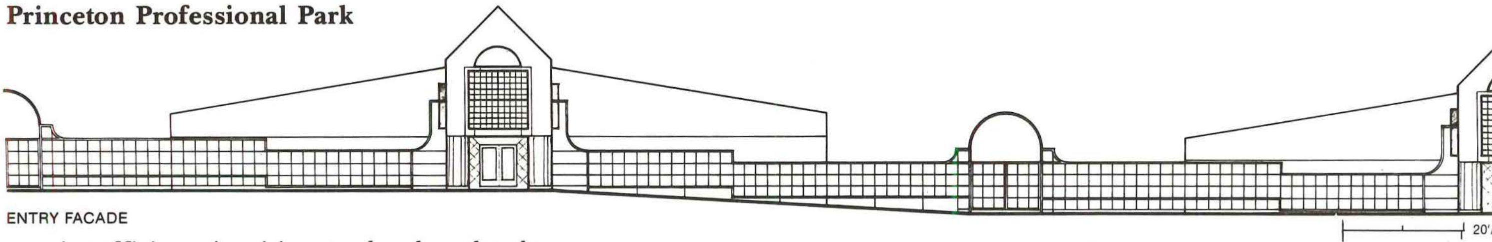
Rather than scattering several double shed-cum-atrium buildings over the entire site, as originally intended, Fraker decided to emphasize the act of entering. He established one long and striking entrance façade, stuccoed and trellised, behind which three parallel double-shed buildings extend about 22 feet. The parking, then, is grouped at th western front of the site, and each building entered through a pedimented portico echo ing the atrium behind. The atriums are en closed spaces with a semi-outdoor feeling they are paved and planted, and their air unconditioned. Offices are entered from th atriums, and secondary office exits lead t garden zones between the buildings. A cross-axis to the buildings, a central pat leads across the site, meandering through th gardens and the building. This path cuts eac atrium at its midpoint, where practical ele ments—ventilating cupola, fire walls—serv the dramatic function of punctuating th spaces. Unfortunately, because of budgetar limitations, the interior "paths" have becom dull gypboard corridors rather than th sophisticated, curved, glass-blocked env ronments originally intended (see axonome ric). Other eliminated features—the archi tectural details elaborating the plywood sid along the garden and the atrium—have le the buildings an honest expression of wh they are: a natural, somewhat rustic enclosu with a sophisticated face.

The energy moves

Fraker and PEG, armed with the recent e perience of developing passive and hybr heating, cooling, and daylighting componer for Butler preengineered metal building teamed up with Princeton architects Short Ford to design similar features into t Princeton Professional Park. They won grant for solar design and analysis co under DOE's demonstration program f commercial passive design, and used co puter analysis, test models, and where da



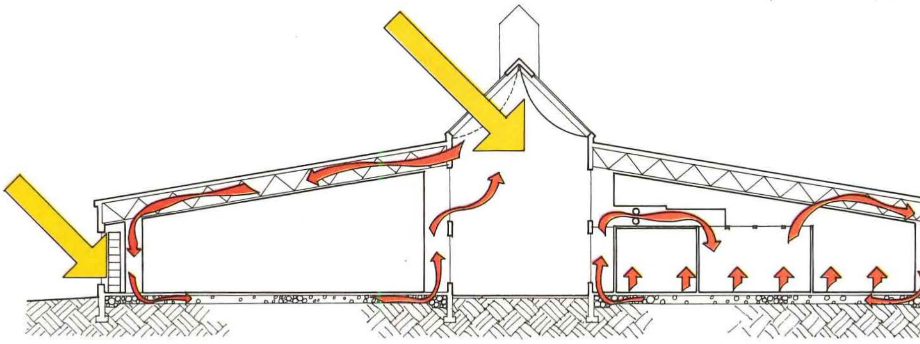
The front of the building—actually, three parallel buildings—is a key to its architectural intentions and major energy-conserving features. It employs urban elements and materials, greeting visitors with a firm stuccoed front and pedimented porticos, as well as garden references—trellises, and gates (not yet complete)—extending across the gardens between each building section. The pedimented porticoes echo the atriums behind them, the major climate-buffering elements of the project, and are themselves repeated in the form of the centrally located ventilating cupolas.



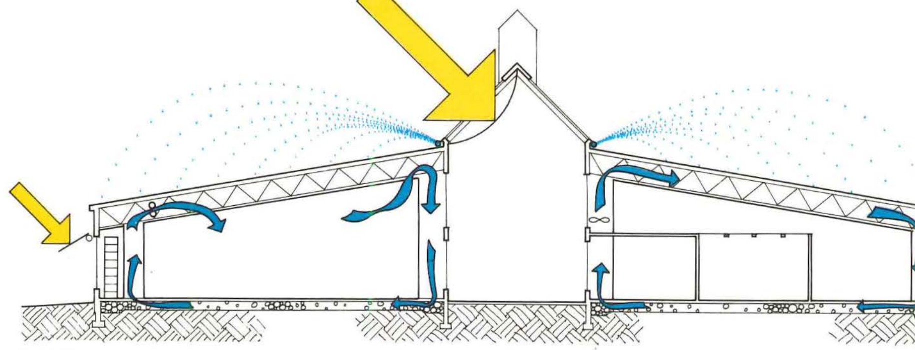
ENTRY FACADE

was insufficient, intuition to develop the design and predict its performance. Predictions were compared with documented costs in a traditional "base case" building to prove the point with the client.

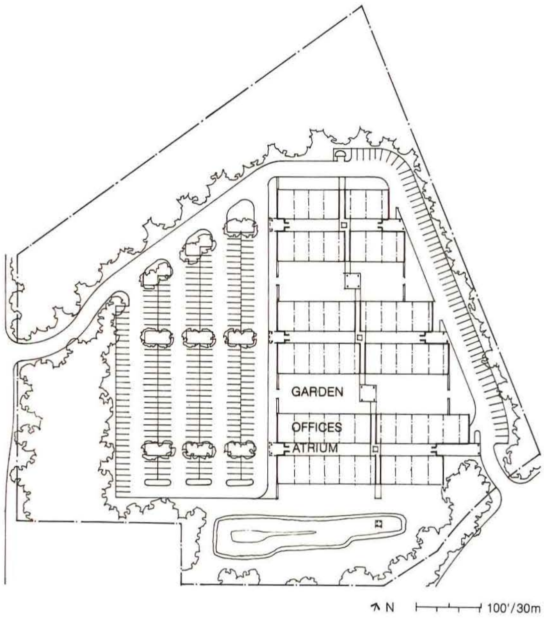
Daylight is admitted to the offices through exterior and atrium walls, the larger window surfaces occurring at the atrium side to minimize heat loss. Tenants have a choice for their ceiling configuration. They can use the full slope of the truss, thereby receiving light directly from the clerestory atrium windows (single thickness Kalwall panels). Or they can suspend translucent panels horizontally at the eight-foot height, filtering the clerestory light. Of course, they may also install an opaque suspended ceiling and forgo the clerestory lighting, but any additional energy costs above an allowance provided by the owner—and each space is metered indivi-

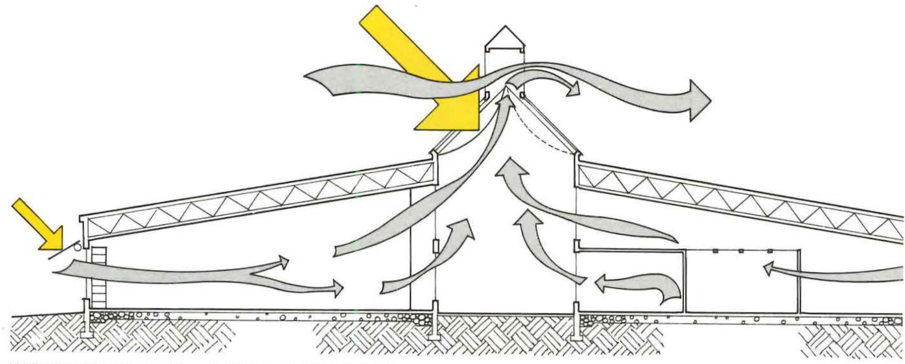


HEATING DAY: STORING HEAT IN ROCKBED NIGHT: HEATING FROM ROCKBED

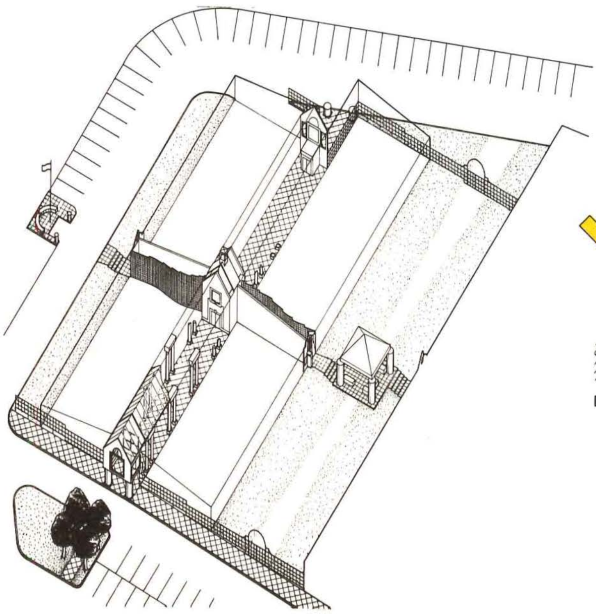


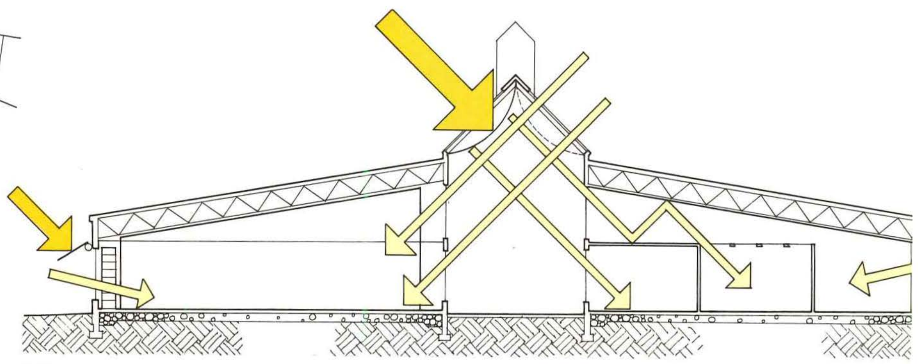
COOLING DAY: GAIN REDUCTION BY SPRAY EVAPORATION NIGHT: SPRAY EVAPORATION AND SKY RADIATION





NATURAL VENTILATION THERMAL AND WIND INDUCED





DAYLIGHTING LANDSCAPE OFFICE—NO CEILING LIGHT SHELF—WITH CEILING

'he atrium (right). A medical of-
ice (above) that uses the full
eight of the sloped truss.

Data

roject: *Princeton Professional Park, Princeton, N.J.*
rchitects: *Joint venture: Harrison Fraker, Architects, Princeton (H. Fraker, partner in charge; S.J. Aronson, office nteriors)—schematic design and esign development; Short & Ford, Architects, Princeton (J. Ford, managing partner; S. Domeschuk, job captain)—onstruction documents through dministration.*
lient: *Princeton Professional Park, A Limited Partnership.*
ite: *10.7 acres.*
rogram: *64,000 sq ft net office pace; surface parking.*
tructural system: *poured conrete slab on grade; 8-ft modular anelized wood stud bearing alls; wood trusses. Steel colmns in atriums for wind load.*
Iechanical system: *hybrid assive cooling and solar heating ystems including evaporative oof-spraying, passive solar trium, underslab rockbed, ½-ton back-up heat pumps.*
Iajor materials: *stucco on ont, T-1-11 plywood on other evations. Double-skinned crylic sheet for exterior atrium lazing, single thickness Kalwall anels for clerestory glazing, -in. fiberglass batt insulation, alls and ceiling. Gypsum board n interior walls (see Building aterials, p. 176).*
onsultants: *Van Note-Harvey ssociates, civil engineering; lackburn Engineering, structral. Solar energy consultant: rinceton Energy Group, R.L. Campo, analyst, L.L. Lindsey, rtner in charge.*
eneral contractor: *The Karell Group.*
osts: *$3,550,000, including lar costs and site work.*
hotography: *Robert Perron.*

dually—comes directly from the tenant's pocket. Tenants can opt for automatic lighting control, either continuous dimming or on-off switching activated by photocell. Under the atrium skylights, white insulating curtains automatically cover the south sides during clear summer days and both sides during winter nights.

Heat collected in the atrium by day is stored in a rockbed underlying the entire 64,000-square-foot office slab, and is distributed by radiation and by a forced air system. Individual fans couple the rockbed/solar loop with backup heat pumps, two 1½-ton units (for compactness and flexibility) per rental module.

Cooling is achieved through ventilation and evaporative roof spraying. Air is exhausted from the offices into the atrium and from there mechanically via the cupola fan. The roof spraying functions in two ways: conventionally, by rejecting heat by day; and innovatively, by cooling the air that circulates under the metal roof during the night and storing it in the rockbed to precool return air during the day. The underroof air loop, however, is tricky. It depends on a perfect vapor barrier to prevent the build-up of humidity, which is a lot to ask in this type of ordinary construction. The architects are waiting to see whether the system will hold up.

The individual mechanical system in each 1100-square-foot rental space is run by a microprocessor-controlled relay panel to produce heating or cooling from the least energy intensive source (cooling first from outside air, heating first from the atrium; then from the rockbed, and last, the heat pump).

The passive cooling and solar heating features added $8 per square foot to the stipulated $37 of the "base building." But energy costs are predicted to be 54¢/sq ft/year, compared to $2.14 for the base building. This represents a five-year payback on the $8 investment, just what the client was willing to accept. Potential tenants seem to be attracted by the energy features. Moreover, Princeton Professional Park is a very pleasant place to be. [Susan Doubilet]

Let them drink wine

Thomas Vonier

What energy was for the 1970s and is still today, water may be for the 1980s and beyond, only more so.

Thomas Vonier, *a P/A correspondent, is head of the architectural firm Thomas Vonier Associates, Washington, D.C., and a principal of the Urban Development Partnership, Washington, and the Leadenhall Group, Baltimore.*

Energy resources and water resources are not unrelated, but there are some significant differences between them, and in the reasons we have to be concerned about them. To begin with, "shortages" of water cannot be dismissed as the nefarious handiwork of government bureaucrats, international cartels, or political adversaries in far-off lands. The difficulties we experience with water stem from sources much closer to home, both literally and figuratively.

Casting a major share of the blame on profligate living styles works much more convincingly for water than it does for energy. Few alternatives to the family automobile may be within the grasp of most Americans, but the same case cannot be made when it comes to the wasteful use of water. Many water-conserving alternatives exist—at low cost and with little loss of convenience.

There's another difference. Water has a much closer relationship to human survival than energy. Speaking perhaps more graphically than many would who share her concerns, Texas architect D. Susan O'Brien nonetheless sums up the basis of concerns about water: "A man can go 30 days without food, 3 days without water and 3 minutes without air. You don't mess around about water . . . this is a subject that gets people riled."

She ought to know. Like many places, Texas has been hit by the combined forces of growth in population and industry, and scarcer water supplies. She and many others see water as the major issue of the decade (it may already be too late, some have concluded), demanding attention and even crusading at all levels of personal and professional activity.

Of course concerns about water resources are not new. Many severe droughts have been experienced during this century, and several are within recent memory, in areas generally regarded as water-rich. New York City, where the average annual rainfall is estimated to amount to only about 40 percent of the municipality's indoor water needs, went through its most serious water shortage in January 1981. This prompted major emergency measures and an alarming cover story about the national water crisis in *Newsweek* a month later.

There is evidence that the problem is no longer, if it ever was, one that will advance and recede with rainfall and the water table. Even the brouhaha over the nation's disintegrating infrastructure has touched on water. Eroded and leaking pipes in the water suppl[y] systems of Boston and Pittsburgh are held re[-]sponsible for the loss of as much as a quarte[r] of those cities' total supplies. St. Louis Philadelphia, Chicago, and a host of other are not far behind.

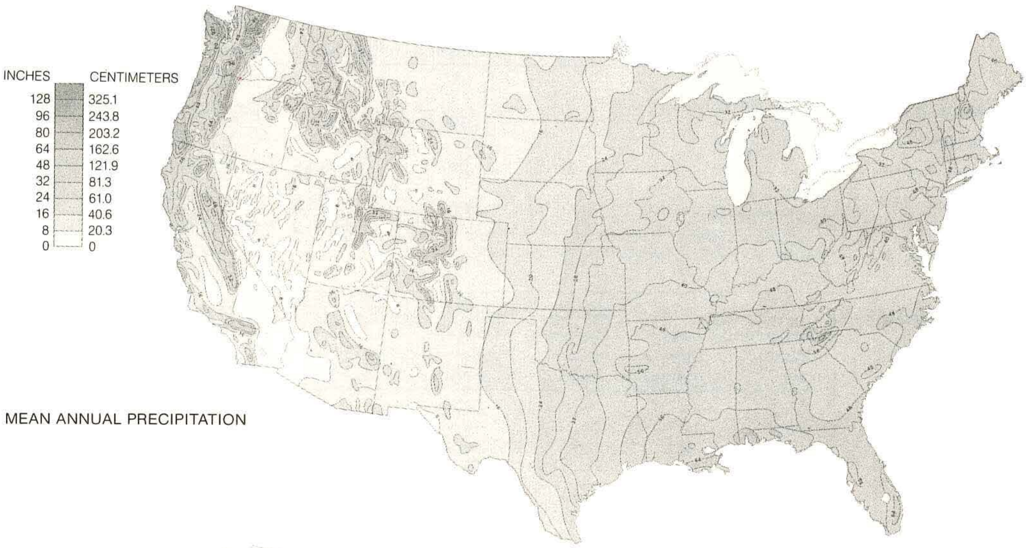
Groundwater contamination

The reasons for our problems with water ar[e] many and complicated. They start wit[h] people and industries in unprecedented con[-]centrations, and most recently in areas tha[t] have never had abundant water supplies. Many studies resist definition of the water re[-]source problem as a national problem suggesting that it results mainly from loca[l] and regional issues that have only local and regional resolutions. Nonetheless, when pro[-]posals are floated to build a water pipelin[e] from the Great Lakes to a region roughly fol[-]lowing the lines of the Louisiana Purchase you know there is a national dilemma some[-]where.

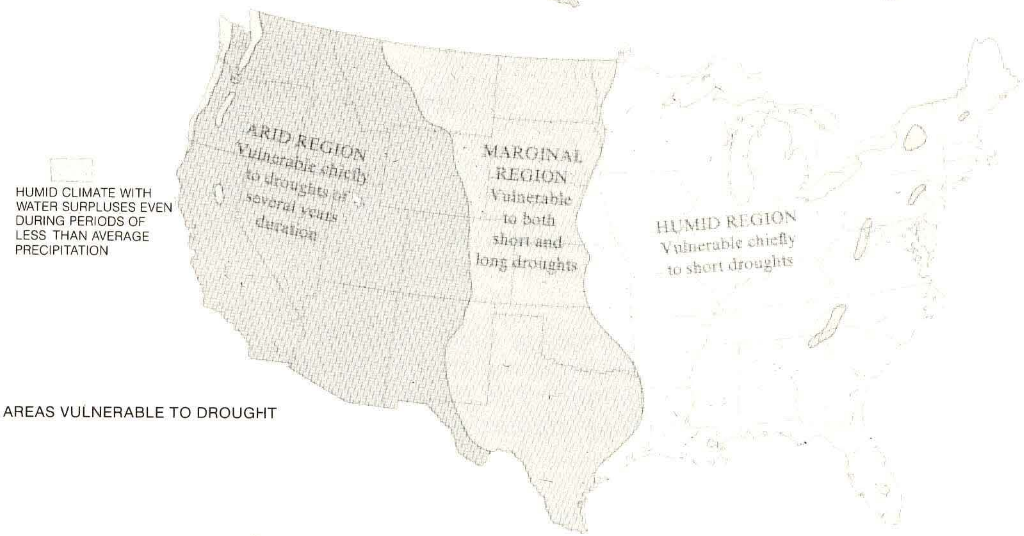
Acting aggressively, under orders fro[m] Congress and prior administrations, the En[-]vironmental Protection Agency took o[n] groundwater pollution as a national malad[y] and cited several major sources:

- Leaking underground storage tanks, par[-]ticularly for gasoline, which tend to be place[d] in populous areas.
- Improper handling, storage, treatmen[t] and disposal of municipal wastes.
- Salt runoff from street deicing.
- Improper handling and disposal [o]f hazardous industrial solvents and waste[s,] especially synthetic organic compounds th[at] are being found increasingly in public wate[r] supplies.
- Fertilizer and pesticide runoffs from ag[-]riculture.
- Saltwater encroachment caused by over[-]pumping of adjacent freshwater supplies.

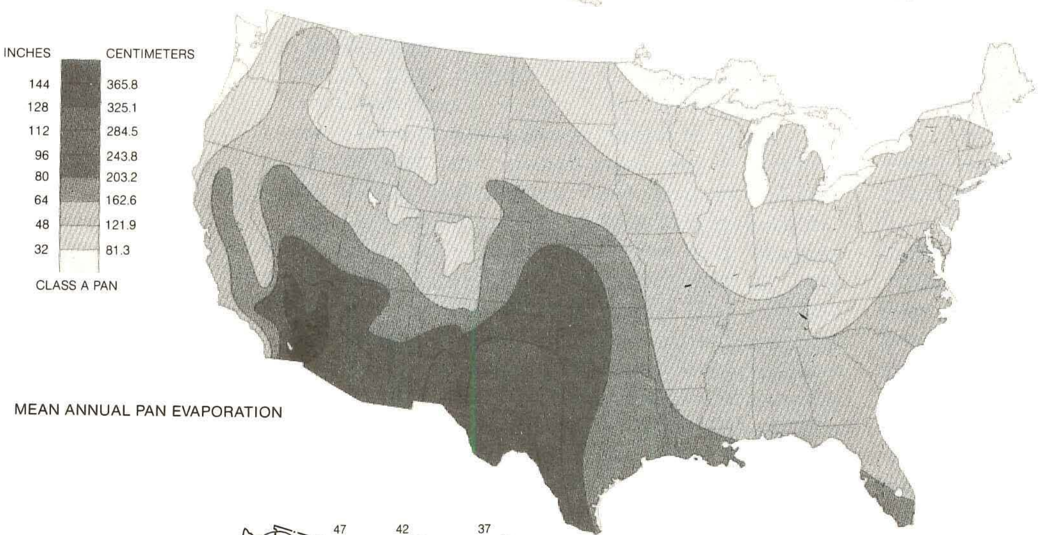
On this last point alone the statistics ar[e] harrowing. All water comes as rain, but [as] much as 92 percent either evaporates or ru[n] off unused into oceans and tributaries. Fully [a] fourth of the water used in the U.S. com[e]



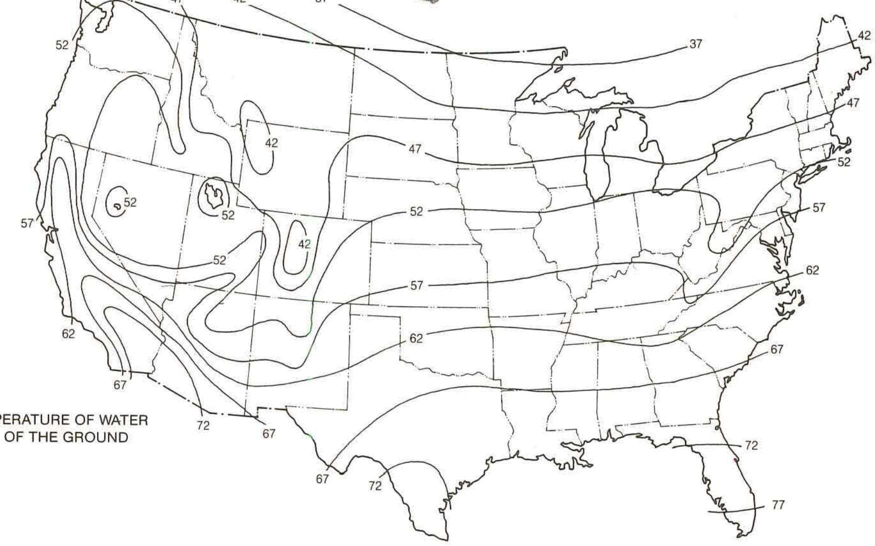
MEAN ANNUAL PRECIPITATION



AREAS VULNERABLE TO DROUGHT



MEAN ANNUAL PAN EVAPORATION



APPROXIMATE TEMPERATURE OF WATER NEAR THE SURFACE OF THE GROUND

The maps from the U.S. Geological Survey (left, top to bottom) show mean annual precipitation, areas vulnerable to drought, mean annual pan evaporation, and approximate temperature of water near the surface of the ground. Drought is exacerbated when evaporation rates peak during the warmer months of April to October, and the vulnerability of it is increasing in areas that previously experienced few difficulties. Class A pan evaporation, shown in the mean annual pan evaporation map, is the measured water lost from a metal pan 4 feet in diameter and 10 inches deep set close to the ground. The map showing approximate temperature of water near the surface of the ground is based on water from nonthermal wells at depths of 30 to 60 feet. Interest is growing in groundwater energy systems, which act as heat- or cool-sinks for space-conditioning systems. The nation's water resources near the surface of the ground appear to be rich in potential for such uses, although some disagreement exists over possible long-term effects on water resources. Water-to-water and air-to-water heat pumps can take great advantage of water temperatures below ground, and water can also be used to precool outside air during the warmest months.

from underground aquifers from which, in 1980, 21 billion gallons more were withdrawn than went in. And as the fresh water goes out, the salt water comes in, either from the oceans or from underground salt deposits. As little as 3 percent seawater content can render such waters undrinkable for centuries.

Water used within and around buildings seems a small portion of the national total when compared with the goliaths of industry, agriculture, and power-generation. But it is more a question of *how* the water is used, not how much. Water resource specialists regard home water use as among the most significant sources of groundwater pollution; they estimate that each housedweller uses about 65 gallons of potable water each day, only three of which are actually for cooking or drinking.

The toilet's revenge

It is not surprising, looking at the statistics, that talk about water conservation quickly turns to talk about toilets. Toilet flushing is responsible for 45 percent of total indoor water use, with the balance (after the 8 percent we swallow each day) going to bathing, laundry, and dishwashing. Very nearly all the water that enters a household is sent right back into the sewers, and nearly 75 percent of it flows through the bathroom.

Although data are scarcer on water uses in nonresidential buildings, there is reason to suspect that "conventional" toilets are a major culprit there, too, and not only because of the inherent wastefulness of flushing. Water closet leakage, says one report, can double water use in a typical hotel. In Chicago's 110-story Sears Tower, according to the Sloan Valve Company, 1037 stalls were refitted with a device that cuts water flow and remedies leaks. The results: 15.3 million gallons of water saved each year, at dollar savings that repaid the costs of the new devices in a short time. The costs of water, and the energy costs of pumping water within buildings and around communities, are not inconsiderable factors in many places.

Shallow-trap toilets and vacuum-breaker flushing devices are demonstrated water-savers (at 5 or 6 gallons a flush per person per day per household, the numbers mount) and sacrifice little in the way of safety and convenience. Flow-restrictors and house pressure regulators have also made significant contributions. These devices are required in a number of localities today for new developments, and have even been credited with "lifting" moratoriums on new sewer hookups. In a twist that links energy to water, one manufacturer of water-saving toilets has calculated that the "old, outdated full-trap toilet" robs the typical household of 16,500 Btu with each flush, based on the heat embodied in 5 gallons of water.

	Uses inside household	Outdoor sprinkling	Total use
Mean annual use	215	160	398
Mean maximum daily use	338	857	1096
Mean peak hourly use	809	2251	2572

INDOOR VS. OUTDOOR WATER USE IN RESIDENCES

Household Water Use	Total Use (percent)	Without Conservation (gpcd)*	With Conservation (gpcd)*	Reduction (percent)
Toilet flushing	40	25	2.5 (2 Quart Toilets)	90
Bathing	30	20	16 (Flow Restrictors)	20
Lavatory sink	5	3	3	—
Laundry & dishes	20	13	9.5 (Water Saving Appliances)	27
Drinking & cooking	5	4	4	—
Total	100	65	35	53.9

*Gallons per capita per day. EPA statistics

HOUSEHOLD WATER USE

The chart showing indoor vs outdoor water use in residences (upper left), compiled by the Department of Environmental Engineering Science at Johns Hopkins University, is based on gallons per day per residence and shows that outdoor uses of water are often more significant than indoor uses. Residences in the study had an average of 3.8 occupants, and an average housing density of 7.6 dwellings per acre. The totals shown are greater than or less than the sum of inside and outside uses because of averaging of consumption over the entire year.

The chart (lower left) shows the quantity and percentage of water used in the average household, and the sometimes dramatic reductions possible with water-conserving fixtures and appliances.

Beyond the water closet

A near preoccupation with water-saving toilets, flow restrictors, low-water appliances, and other plumbing devices may have obscured several other areas of real opportunity, many of which are likely to be more interesting and stimulating for designers. Studies suggest that water used *outside* of buildings for lawn and garden irrigation, car washing, and other purposes, is probably at least as significant as water used indoors. Cisterns and other devices used to collect, filter, and store rainwater are still familiar in many parts of the world and appear to have potential in contemporary U.S. applications, provided troubles with acid rainwater can be overcome. Advances have been made in the technology for graywater recycling and "waterless" waste disposal systems, although there is still resistance to these approaches in many quarters. Household water filters are enjoying renewed popularity, even if much changed from their 19th-Century predecessors in England and Europe.

Landscape plans can be examined from at least two vantage points. First, from the consequences for water of a given design approach. D. Susan O'Brien says, "As architects we can and should determine the irrigation needs for a development. . . . just a simple practice such as letting the grass grow longer can conserve 50 percent of water use." The California state transportation department and the state architect's office have launched a five-year program aimed at planting the state's freeway system with native, drought-resistant plants, including golden yarrow, native holly, chaparral, and sturdy live oak. San Diego water conservationist Wayne Tyson comments that "most of the things you see now, the iceplant and the ivy, are alien to this area and need way too much water."

The second vantage point from which landscape plans can be examined concerns the handling of water runoff, which is of vital importance. Large roof areas and parking lots present especially challenging design opportunities. Several major companies have found it advantageous to capture water runoff for on-site treatment and storage, citing lower or equal costs and the added benefits of recreational or energy-system ancillary uses.

Waste not, want not

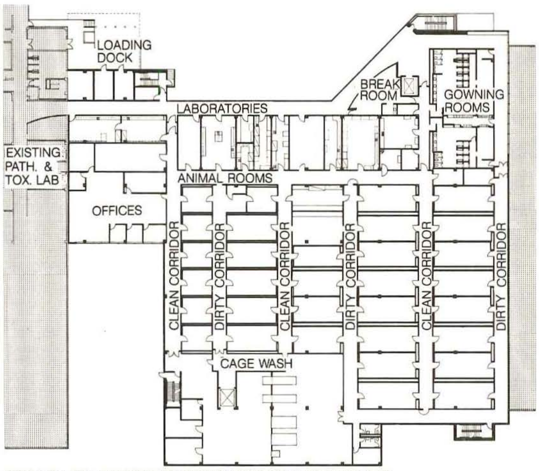
Attitude is a key to this resource dilemma. In other times, even "waste" products were, and in some cultures still are, regarded as valuable resources. And now water must clearly be counted as a resource not to be disposed of lightly. With interest in the use of groundwater for building energy systems mounting, and the costs and availability of potable water called into question almost daily, we can expect architects and their colleagues to be confronted rather directly by the challenge of conservation.

Water-saving approaches and devices appear to be achieving greater currency in new designs, with water-conscious manufacturers making large contributions to the range of choices available. One suspects, however, that shifts of a more fundamental character may need to take place before the challenge is well met. We may not be headed back to the communal baths of the 1800s (although some have taken encouragement in the proliferation of hot-tubs), but there are signs that suggest we're headed toward what O'Brien calls "the arid-land lifestyle." Not all of it is discouraging, for, as she points out, we'll be drinking more wine than water. □

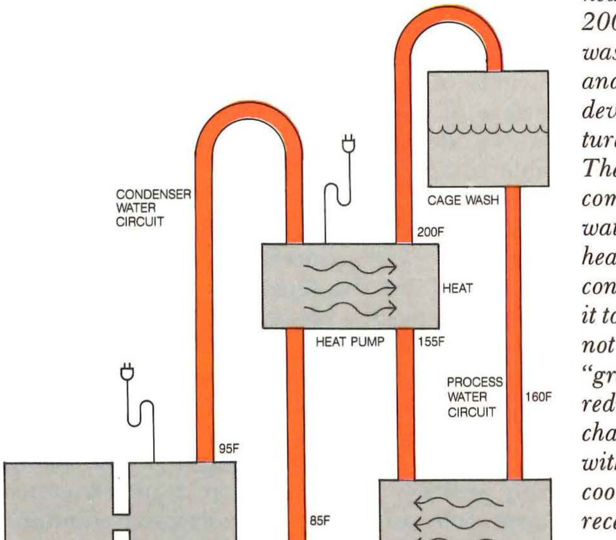
Acknowledgments

We would like to thank the following for their contributions to this article: American-Standard; Bradley Corporation; Eljer Plumbing; Ifö Sanitar AB, Sweden; Murray Milne, UCLA; Microphor; Building Research Establishment, U.K.; National Bureau of Standards; Arthur N. Orans, Corvallis, Oregon; U.S. Geological Survey; U.S. Environmental Protection Agency; Sloan Valve Company.

Arthur N. Orans



SMITHKLINE BECKMAN CORPORATION LABORATORY
TYPICAL FLOOR PLAN



PROCESS-WATER HEAT CYCLE

Control of runoff from paved areas (above) is critical to water resource management. Even simple measures like providing rock mulch and low-water plantings in parking areas, with catchment draining, can make a large difference in whether runoff helps or hurts.

A new pathology/toxicology laboratory at SmithKline Beckman Corporation's pharmaceutical research facility in Upper Merion Township, Pa. (plan, left, process-water heat cycle, below left) calls for the use of nearly 80,000 gallons per day of 200 F water for animal cage washing. Ballinger Architects and Engineers of Philadelphia devised a system that will recapture heat from the wash water. The effluent is used to heat incoming wash water; the new water is heated to 155 F, and heat rejected from the air-conditioning equipment elevates it to the 200 F required. While not quite extracting all of the "graywater" heat, the scheme does reduce the temperature of the discharged water to legal limits without resorting to additional cooling water. Ballinger's design received an Owens-Corning energy conservation award.

Power play

Harvey Bryan

Power conservation rather than energy conservation tends to be the driving force in large commercial building design.

Power is the *rate* at which energy is used. The concept of power conservation—controlling the extent and timing of the peak demand for electricity—is an extremely important yet often neglected aspect of energy-conscious design. Power conservation is most significant in commercial buildings that have large internal loads (which usually have a high electrical demand), especially in areas of the country where the electric utilities have a demand-sensitive rate structure. In such instances, energy-conscious design strategies should focus primarily on reducing or shifting the building's peak power demand and secondarily on reducing annual energy consumption. This is not to say that energy conservation and power conservation are competitive or mutually exclusive concerns, but rather that different priorities and perspectives need to be employed when looking at the problems associated with the design of large, internal-load-dominated buildings in many parts of the country.

The recent past

Events of the last decade have made us all aware of the importance of energy as it relates to design practice. Yet there is considerable disagreement as to the best approach that energy-conscious building design should be taking, especially where large commercial buildings are concerned. Early opinion suggested that this type of building should be thermally tight, with as little surface area and as few penetrations as possible. Others disagreed, however, arguing that the issue was one of understanding the energy dynamics rather than legislating tight standards that would later have to be changed. Those taking this position suggested that a performance approach rather than a prescriptive standard would be a much better mechanism in first understanding and later controlling the various energy flows to and from commercial buildings.

Most designers would agree that the performance-based approach is superior to a prescriptive standard. As the performance approach developed, however, it did little in helping to understand the issues associated with energy conservation or, for that matter, power conservation. Many of its developers promoted it for code-making purposes rather than for exploring the tremendous educational potential that such an approach could have provided designers. As a code-making vehicle, the performance approach was limited to determining how much energy a build-ing would consume, i.e., its energy budget (which is usually expressed in Btu/sq ft/year).

The energy budget concept—annual con-sumed energy measured at the building boundary, divided by the area of the building—was first used in 1975 by the Gen-eral Services Administration to target energy performance for all new (55,000 Btu/sq ft year) and existing (75,000 Btu/sq ft/year) fed-eral office buildings. This method of energy accounting (which is properly called an end use energy budget) is the most commonly applied, and the one that is most typically presented in published case studies and build-ing comparisions. Although it is the mos widely used method of accounting, it is also the most misunderstood and has often led de-signers to make poor energy-related design decisions. For example a building that use 55,000 Btu/sq ft/year measured at the build-ing boundary can be very efficient or ineffi-cient depending upon the fuel that is used Such a building will be highly efficient i natural gas is used, whereas the opposite wil be the case if the building is all-electric. Thi is because it takes approximately 3 Btu's o natural gas or fuel oil to generate and delive 1 Btu of electricity to a building. Thus, b definition, end-use energy budgets exclud all off-site energy subsidies and tend to bia this method of accounting by as much as factor of three when compared to the actua energy required to operate a building.

Recognizing many of the problems as sociated with end-use energy budgets, th Department of Energy, through the the proposed Building Energy Performanc Standards (BEPS), attempted in 1979 to con vert end-use Btu's into a more meaningfu value. DOE proposed that BEPS be based o a source energy budget concept. Annua energy consumed by the building would b broken into fuel type, with each type bein multiplied by an appropriate weighting facto (which takes into consideration energy effi ciency beyond the building boundary as we as the value to the nation of conserving dif ferent fuels), summed, and then divided b the area of the building. Although thi method of energy accounting requires mor elaborate calculations, it was thought that it increased accuracy would lead to its wide us (even though BEPS did not become law

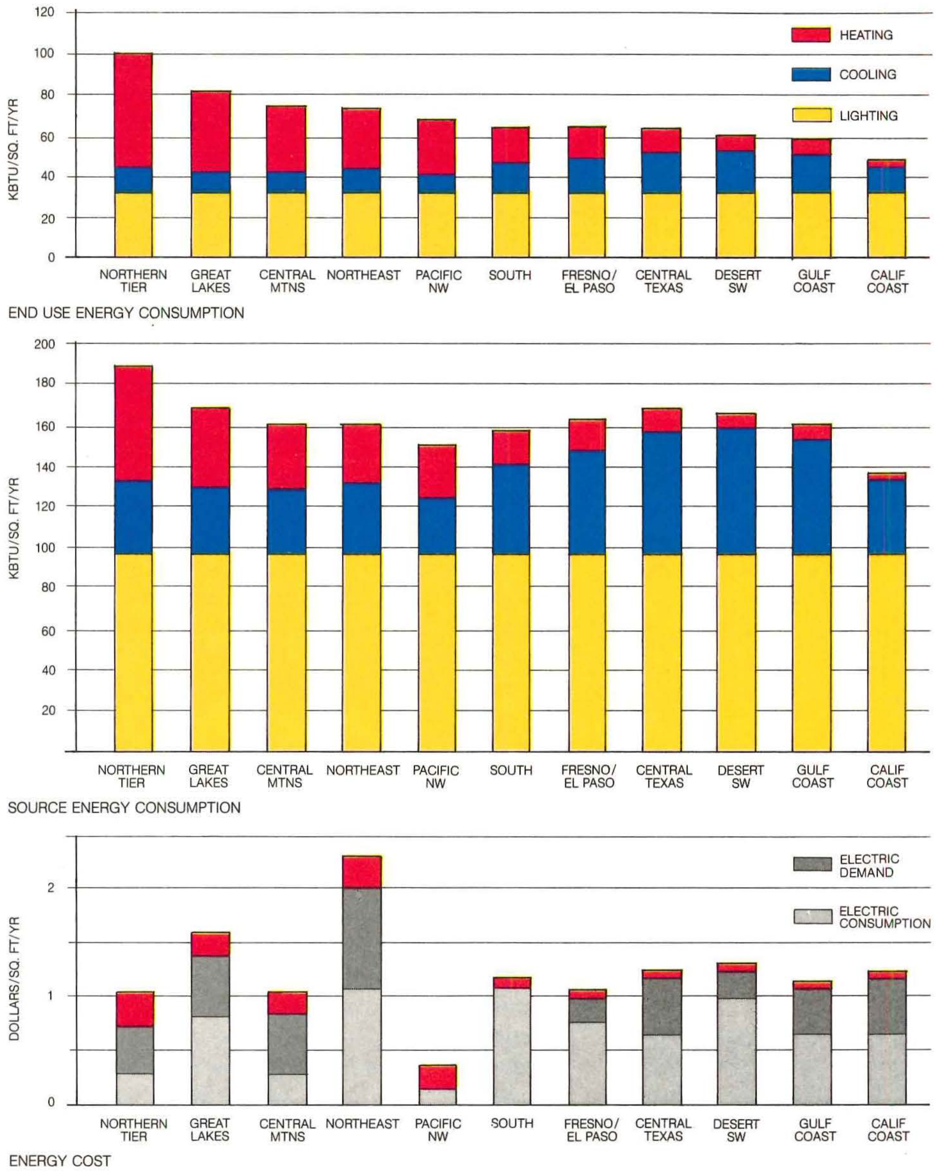
Harvey Bryan *is an architect, researcher, and frequent contributor to P/A in the area of energy-conscious design. He is currently an assistant professor at MIT.*

There has been little agreement on the appropriate weighting factors, however, especially since the original BEPS weighting factors were based on national averages which neglected many important regional differences. For example, an all-electric building in the Pacific Northwest, where efficient hydroelectric is plentiful, would be penalized equally for using electricity as an all-electric building in the Northeast, where less efficient fossil-fuel-generated electricity prevails. Thus, it has been found that source energy budgets using national weighting factors can be biased by as much as a factor of 2 when comparing the actual energy required to operate buildings by region.

Today, there is a growing shift away from the energy budget approach because it has performed so poorly as a measure of energy performance, especially in buildings that have high electrical demand. Also, many of the costs associated with electrical power generation cannot be accounted for with the energy budget approach. This failure to reflect accurately on issues related to the use of electricity in buildings is of critical importance. It is often the case that upwards of 75 percent of a commercial building's energy needs (all lighting, most equipment, and very often cooling) requires the use of electricity.

To overcome these limitations, many designers are increasingly turning to the use of an annual energy cost approach: annual energy used by a building would again be broken down by fuel type, the electrical component being multiplied by the local utility's cost (in terms of both energy consumption and demand), summed, and then divided by the area of the building. Such an approach more accurately incorporates the embodied energy (source energy) and the embodied capital required to maintain utility capacity (which is usually reflected in demand charges). The latter is of considerable importance since few realize that a utility has to invest as much as 20–30¢ in new generating, transmission, and distribution equipment for every dollar spent on new building construction. Thus, for the local utility, and ultimately for the building owner who pays the bills, the control of the peak power demand offers tremendous cost and energy savings potential. A recent study by the Solar Energy Research Institute confirms the need to control peak demand; it states: "two to three times more nonrenewable energy can be saved on a national basis by reducing the peak rate of energy use in commercial buildings than by equivalent expenditures that focus on limiting annual energy consumption."

As power conservation becomes an issue in energy-conscious commercial building design, many of the recently developed energy conservation strategies that have been based on an energy budget approach need to be reexamined. For example, increasing the thermal integrity of the building envelope, reducing surface area, reducing window area, etc., make a great deal of sense for an office building in the Northeast if we look at end-use energy (where a large portion of energy goes for heating). That same set of strategies makes less sense if we look at source energy (where considerably less energy goes for heating), and little sense if we look at energy cost (where relatively little in the way of cost goes for heating). This is not to say that conservation strategies such as increasing the thermal integrity of the building envelope should not be incorporated into any final design, but given limited resources, reducing lighting demand (use of daylighting) and cooling demand (off-peak thermal storage) would be better options to explore.



Lawrence Berkeley Laboratory

William I. Whiddon

The top graph shows the simulated end-use energy consumption of a typical office building in various high heating to high cooling regions.

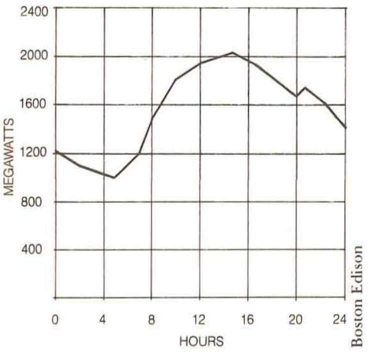
In the middle graph, end-use consumption is converted into source energy consumption assuming electrically supplied lighting and cooling (using the BEPS weighting factor of 3.08) and natural gas heating (with a weighting factor of 1).

The building's actual energy costs in the bottom graph show how end-use or source consumption may not reflect the expense of energy in various regions.

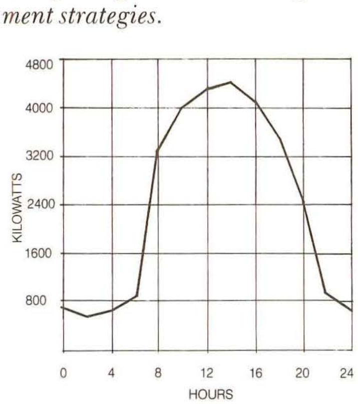
Extending the building boundaries

If we now extend the building boundaries to include the utility, it becomes necessary to examine briefly the services that it provides. During the first 70 years of this century, electric utilities experienced a rate of growth unparalleled in U.S. industry. Today, the same industry is faced with myriad problems: staggering capital requirements for new equipment, escalating costs for unstable fuel supplies, ever-mounting environmental pressure, decreasing growth rates, and regulatory

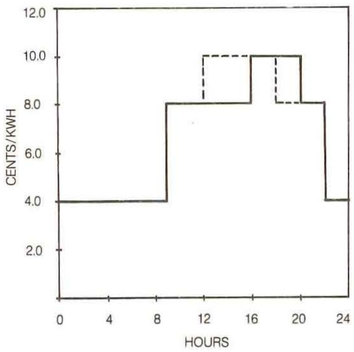
Power conservation



This load curve exemplifies the peak daily electrical demand placed on utilities. Utilities now try to lower or shift peak demand with pricing and load management strategies.



This is the daily demand curve for a large, all-electric office building. Buildings are the single largest contributors to peak electrical demand.



This graph charts the typical time-of-day rate structures for summer (dashed line) and winter (solid line).

and consumer concern about increasing costs. Utilities are increasingly unwilling to risk their own financial stability in order to meet peak demand (which usually occurs for only a few hours on a summer afternoon), and are now seeking ways to spread out demand in order to lower the peak cost and reduce the need for new power plant construction. Utilities have finally discovered what many of their critics have been saying for years, that it is cheaper to reduce demand than to build new capacity. As a result, there is widespread questioning of almost every facet of the industry. Such questioning has opened up a variety of innovative options that may make both the utility and its customers happier. Designers need to become aware of these options in order to serve their clients better.

The two options that most utilities have in place or under consideration, which will have an increasingly significant impact in the coming years, are electrical rate reform (shifting to a demand-sensitive rate structure) and load management (the utilities' term for controlling demand).

Historically, utilities' rate structures were designed neither to maximize profit (which is controlled by regulation) nor to reflect the true cost of providing service: they were designed to encourage the growth of electrical use. It must be remembered that only through expansion can a regulated monopoly (whose profits are based on a guaranteed percentage of invested capital) show increasing profits to its shareholders. Thus, the rate structures tend to promote consumption by reducing the rate charged per unit of electrical power consumed. Such rate structures are used less as regulatory pressures and financial realities mount. Replacing such structures will be demand-sensitive ones which typically charge for both consumption and demand as a function of time of use. Consumption charges will use time-of-day mechanisms, which require rates to vary in discrete periods over the day in an attempt to follow the utility's load profile. Usually (assuming a summer-peaking utility), rates will be low at night, increasing in two or three blocks to the peak rate in the afternoon. Such rate structures have been in use in Europe for a number of years and have been shown to encourage off-peak use of electricity without promoting growth in total consumption. Demand charges require a premium to be paid for the highest 15- or 30-minute demand that occurred during the billing month. Many utilities are also stipulating the use of a "ratchet clause," which requires that a percentage (often at levels as high as 80 percent) of the year's maximum demand be extended as a fixed demand charge through the remaining 11 billing periods. Thus, a building owner may pay an enormous penalty for just one 15-minute surge in demand.

Utilities also are implementing programs that encourage the displacement of peak power demand, i.e., load management. These programs vary from spot messages on the radio during critical peak demand periods—advising customers to shut off nonessential equipment—to planned interruptions of service (rolling blackouts). Utilities have been experimenting with load management since the early 1950s; until recently, however, there have been few serious applications. Today, advances in micro-electronic controls provide several attractive approaches to load management, especially in the area of direct load control. Several large utilities are now involved in projects for purchase and installation of micro-relay control devices in customer equipment. Such devices allow the utility control over the operation of that equipment through either radio, telephone, or ripple signals (signals transmitted through the power lines). Customers benefit from lower cost, while utilities benefit from the ability to orchestrate loads better as well as the option of avoiding blackouts which are undesirable and expensive in terms of potential liability. Since the utilities own these devices, capital investment is increased and so are profits. This latter point has prompted many in the energy-conscious design field to suggest that these relatively small investments on the part of utilities in on-site load management could very easily turn into partnerships with building owners in the financing of major power-conserving features of a building.

Strategies for power conservation

Energy conservation strategies, though, do need to be studied carefully in relation to their impact on power demand, because there have been occasions where the two have worked at cross purposes. The following strategies should be looked at as a check list to consider and are not meant to be exhaustive: innovative strategies for power conservation are constantly being proposed. Nor should these strategies be incorporated into buildings in lieu of the numerous energy conservation strategies that have been developed over the last several years.

1 (Computerized) power management systems: Several building controls manufacturers currently market sophisticated microprocessors with packaged software designed to reduce electrical equipment operation during periods of peak demand (called in building management: load-shedding). These systems should not be confused with Energy Management Systems (EMS). Although some EMS can provide power as well as energy management, many have not been as flexible as we have been led to believe. Before specifying any computerized management system, a comparison of various system features should be undertaken, particularly in the area of control software and software servicing. A good indication of a manufacturer's commitment to load-shedding is the extent of its programs and its willingness to service those programs under that title. This latter point is extremely important. Since ower management is so dependent on hanging utility rate structures, software will eed to be modified. Utilities, for some time, ave been aware of the load management po- ntial that these systems offer; it would be a atural extension of its previously mentioned rograms if, in the not too distant future, ilities seriously consider the purchase and stallation of such equipment in commercial uildings.

2 Daylighting: Since electric lighting is ften the single largest user of energy in ommercial buildings, much attention has een focused on the energy-saving potential f daylighting (see Tom Vonier's article, page 6). However, few have recognized the po- ntial that daylighting offers for the control f peak demand; i.e., most utilities peak on ot summer afternoons, which is coincident ith peak daylighting availability. The re- archers who have studied daylighting's rela- onship to peak demand have found that the vings derived from a demand-driven analy- s are significantly greater (in some cases sev- al fold) than those derived from an nergy-driven analysis. Thus, many of the aims being made for daylighting may be on e conservative side. Designers choosing to ase their daylighting designs on a demand pproach can significantly reduce their analy- s effort. Whereas an energy approach re- uires detailed daylighting analyses that then ust be integrated into a thermal analysis odel (usually one of the large computer odes, such as DOE-2 or BLAST), a demand pproach requires only a few calculations sually for a few hours during a summer af- rnoon). Lighting control hardware is also gnificantly cheaper for a demand-driven aylighting design, which uses simple on-off vitching, rather than the more expensive mming control that results from an nergy-driven daylighting design.

The considerable interest that daylighting attracting has prompted several utilities to egin exploring daylighting as a load man- gement strategy (two of the nine sponsors of e recently held International Daylighting onference in Phoenix were from the utility dustry). Utilities are interested in daylight- g because, through the installation of sim- e on-off relays connected to perimeter of- ce lighting (which would be activated by a pple signal), they can control a significant ortion of their load.

3 Off-peak thermal storage: As more ilities shift to demand-sensitive pricing, f-peak thermal storage is increasingly being ed to take advantage of cheap, off-peak ower to generate thermal energy (usually r cooling purposes), which is then stored r use during the peak periods of the day. ff-peak thermal storage can take the form either centralized (usually in the basement) ater or ice storage (see P/A, April 1981, p. 0), or decentralized storage in the building ass itself. Either arrangement involves a nsiderable design effort, although tech- ques for the design of centralized storage ncepts have advanced more rapidly than ose of decentralized storage. Decentralized orage, however, may prove to have consid- erable cost advantages over centralized con- cepts because of its incorporation into the structural costs of a building.

The utilities have been extremely suppor- tive of off-peak thermal storage. For exam- ple, Southern California Edison is actively encouraging the use of such systems by insti- tuting a design assistance program that will pay up to 50 percent (up to a maximum of $5000) of an off-peak thermal storage feasi- bility study. Such programs could easily evolve into some type of financing or even owner- ship of the off-peak thermal storage systems by the utility.

4 On-site power generation: As utility cost and unreliability increase, many large build- ing owners may choose to generate their own on-site power. In 1981, 16 of Con Edison's largest customers, with a total peak load of 26,000 kW, chose to install their own on-site generating facilities. On-site power genera- tion can be defined as either a total energy option (a building's entire energy and power needs being provided by on-site equipment) or a selective power option (a selective por- tion of the power needs of a building will be provided by on-site equipment). Each option has a significantly different level of cost and benefit which must be thoroughly analyzed. Today, on-site power generation is a strategy that is feasible only for the very large building owner. Recent changes in federal law as well as technological advances, though, may make on-site power generation attractive to even small building owners.

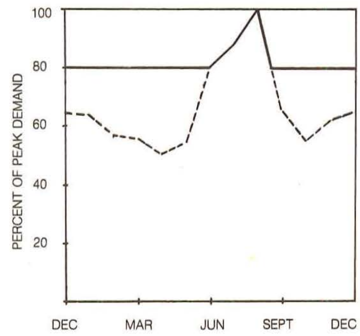
Utilities obviously discourage privately owned on-site power generation (although they may at times encourage selective power generation); therefore, anyone comtemplat- ing such a facility will need to do legal as well as technical homework.

Conclusion

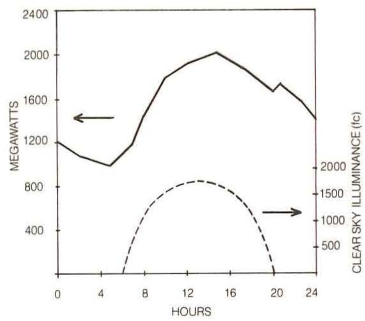
Architects are increasingly being asked by building owners to reduce energy costs. Minimizing peak power demand provides the largest cost savings in the shortest amount of time and at the least expense to the owner. In the late 1970s, architects made the difference between energy-conserving buildings that worked and those that did not. Today, we have the same challenge before us in power conservation. □

Acknowledgments

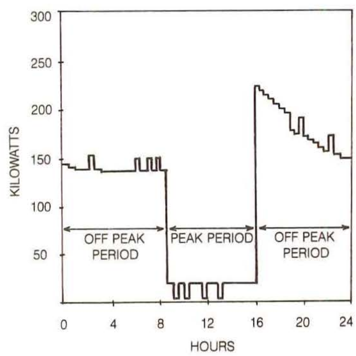
Thanks are due to the following architects, researchers, and organizations for sharing their information: Brandt Andersson, Lawrence Berkeley Laboratory; Charles Benton, Georgia Tech; Harrison Fraker, Princeton Energy Group; James Jewell, Electric Power Research Institute; R. Christopher Mathis, Owens-Corning Fiberglas; Claude Robbins, Solar Energy Research Institute; Steve Selkowitz, Lawrence Berkeley Laboratory; and William I. Whiddon, William I. Whiddon & Associates.



This seasonal demand curve compares actual demand (dashed line) with the demand that will be charged assuming an 80 percent ratchet clause (solid line) for an all-electric office building.



The coincidence of a typical utility's load curve (solid line) and clear sky illuminance (dashed line) shows how daylighting can be a load-management strategy.



This represents the typical summer chiller demand of an office building using off-peak storage.

Up in the air

The conservation of energy and indoor air quality need not be conflicting goals. Both the causes and cures of indoor pollution are diverse and often surprisingly simple.

Fred S. Dubin, P.E., president of Dubin-Bloome Associates P.C. and a leading energy consultant well known to P/A readers, has been studying indoor air pollution as part of a transdisciplinary team under the auspices of the Canadian Government. In the following conversation with P/A Technics Editor Tom Fisher, Dubin describes that study and discusses what is known and still unknown about indoor air quality.

Fisher: Why has there been so much interest in indoor air pollution in the past few years?
Dubin: There are several reasons. First, people have been getting sick in buildings. Studies by Lawrence Berkeley Laboratories and Harvard's School of Public Health have shown that indoor air is frequently more contaminated than the air outside. Since people spend 80 to 90 percent of their time indoors, that contamination is bound to create health problems.

Half of the students and faculty in an Oakland high school experienced eye irritation, difficulty breathing, headaches, skin irritations, and nausea. Elevated formaldehyde levels were recorded in the building. In Maine's Department of Transportation building, workers developed coughs, colds, stiffness, and in one case, a lung disorder, which were linked to the fraying of fiberglass ducts. It's sometimes difficult, though, to get definitive answers because of the sensitivity of lawsuits. On one floor of Simon and Schuster's offices in New York, about 160 people experienced symptoms. They were moved to another building, the floor was remodeled, and no further problems were reported, although we're still not sure what was the cause.

Second, the publicity surrounding the air quality problems in California's Bateson Building has led some to question the effect energy conservation has on indoor air quality. Energy conservation, per se, is not the major cause of indoor pollution. A 1971 study, funded by OSHA, found high levels of indoor pollutants in non-energy-conscious buildings. But conservation can be a contributing factor if the number of air changes is reduced or, as in the Bateson Building, people move in during the initial outgassing of materials and before the energy systems have been adjusted.

Third, while there has always been indoor pollution, improvements in the quality and sensitivity of instruments have enabled us to detect and measure contaminants with more precision. What's different now from even few years ago is our ability to analyze th problem.

Fisher: What are some of the major indoo air contaminants and their sources?
Dubin: The major sources are a building materials, its contents, and its occupant Among the building materials, you get rado and other radioactive elements from ston and concrete, formaldehyde from part cleboards and certain insulations, and organ pollutants from glues and adhesives. There also asbestos in fire retardants and lead an mercury in paint.

Among a building's contents, combustio appliances for heating and cooking give o formaldehyde, nitric oxide, nitrogen dioxide and carbon monoxide. Copy machines em radon while synthetic fabrics outgas variou organic contaminants.

Occupants, of course, give off moisture. I is their activities, however, that are mo harmful: carbon monoxide from tobacc smoke, fluorocarbons and vinyl chloride fro aerosol spray devices, organic pollutants fro cleaning products, and carbon monoxide an lead from automobile exhaust.

Health effects

Fisher: What are some of the known healt effects of those pollutants?
Dubin: Tolerences vary widely amon people, for their sensitivity depends upo their genetic susceptibility to certain diseas and the duration and concentration of the exposure to a pollutant. We still need define, in medical terms, what's safe and wh isn't safe, at what concentrations and und what conditions, because the complete elim nation of indoor pollution may not be prac cal or economically feasible.

The major symptoms of indoor contamin tion include headaches, nausea, sleepine fatigue, rashes, sores, and irritations of ey nose, and throat. Chronic problems inclu liver damage and lung inflammation fro aerosols, kidney and bone marrow dama from lead, cancer from formaldehyde, rado and asbestos, and death from carbon mono ide.

Fisher: How are indoor air contaminants d persed throughout a building?
Dubin: Pollutants move through a buildi according to local air circulation and distrib

on patterns. The objective is to flush con-
ıminants out of a building as soon as possi-
le. Even if there are sufficient air changes in
space, that objective can be prevented by the
ross-contamination of air intakes and exhaust
r by too great a return air suction in the
IVAC system, which may keep the ventilation
ır above occupant level. Office partitions can
lso interfere with air circulation, creating
ockets of contamination at desk height.

ontrolling indoor pollution

isher: How can architects and engineers ontrol the accumulation of indoor pollution?

ubin: There are a number of fairly simple recautions they can take. Perhaps the most bvious is the avoidance of certain building roducts that some people find irritating fter continuous exposure: plastics, especially oft plastics; glues and adhesives; composi-on boards, such as plywood and chipboard; aints and sealers; synthetic fabrics and car-ets; foamed plastics, either in rigid insula-on or in flexible furniture padding; and ıbber products. Materials such as hard-oods, metals, ceramics, concretes, plasters, ass, natural fibers, and baked enamel sur-ces might be a partial substitution for such ıaterials.

Electric or solar heating systems avoid ıe problems of combustion furnaces, al-hough the latter have been successfully used hen sealed off from the rest of a building in room vented directly to the outside, with ater as the circulating medium. Clustering ources of contamination within enclosed, ell-ventilated rooms also works for equip-ıent such as copy machines and appliances. awrence Berkeley Laboratories has shown ir-to-air heat exchangers to be effective in emoving pollution without evacuating all of ıe heat in a space; that effectiveness, though, aries with the type of contaminant, the type f heat exchanger and its installation.

There are a couple of ways of preventing ockets of contamination in an open office pace. A six-inch gap between the floor and ıe bottom of a partition will increase air ıovement around desks, while directing dif-ısers will distribute more air to a seated orker.

It's often difficult to isolate the specific ıuses of pollution. When, for example, you ook at the contaminants that come from leak-ıg ballasts or vaporized plastic diffusers in uorescent lights, it leads immediately to ev-ything else that affects air quality. You end p looking at total building performance ıther than just lights.

isher: How can contaminants best be re-ıoved?

ubin: Short of removing materials, which ın be expensive and may not always be ecessary, contaminating sources can be en-ıpsulated by sealing cracks in basement walls to stop the entry of radon from the surround-ing soil; confined by having separate rooms for smokers, for example; or used at off hours, such as painting or running appliances when people are gone. Other options include increasing the number of air exchanges or installing air cleaners that filter, absorb, or electrostatically attract gases or particulates. It is important to monitor peoples' activities and test their reactions to particular items before making costly changes.

Fisher: What are some of the effects of energy conservation methods on indoor air quality?

Dubin: A well-insulated building requires less heat and thus minimizes the pollution of combustion heating systems. Solar heating, of course, can eliminate the problem. Also, reduced infiltration can decrease the amount of outside pollutants entering a building.

Increasing the amount of ventilation or air movement is not always the answer. Greater air movement can sometimes increase the outgassing of certain pollutants, and if the rate of chemical reactions is high compared to the rate of air changes, the amount of air movement might have little effect on the concentration of contaminants.

What you have to determine is the relationship between air movement and the quality of indoor and outdoor air. The solution might combine a variety of options: installing heat exchangers, removing contaminating sources, reducing the relative humidity, flushing the building at night—all of which can greatly improve indoor air quality without necessarily reducing energy efficiency.

Fisher: What steps can be taken when the level of outdoor pollution is greater than that indoors?

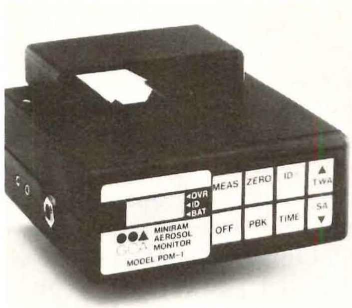
Dubin: It is important to control natural ventilation, especially when weather stations predict high pollution levels or when construction work, such as installing a built-up roof or painting, is going on nearby. Maintaining a positive building pressure and facing air intakes or entrances away from the prevailing wind or exhaust outlets will reduce infiltration. Updrafts and downdrafts created by adjacent buildings or topography and the negative internal pressures on the leeward side of a structure should also be factored into the location of openings when trying to minimize the effect of external pollution.

Fisher: Does the geographical location of a building affect the level of contaminants?

Dubin: We don't know for sure what effect location has. It is thought that areas near uranium or phosphate mines might expose buildings with poorly sealed or vented basements to higher levels of radon, and that areas near coal-burning sites might expose them to higher levels of sulfur dioxide. But research still needs to be done.

Fisher: What was the nature and intent of the Canadian study you were involved in?

Dubin: First of all, it is a continuing program; it hasn't ended. The Building Sciences Division of Canada's Department of Public Works



Indoor air pollution has led to the development of instruments (above), small enough to be attached to clothing or worn in a pocket, that monitor for contaminants such as carbon monoxide (top), dust (middle), or radon (bottom) and that sound an alarm when concentrations of those pollutants become excessive.

formed a transdisciplinary team with members from the public works department, a behavioral scientist, a chemist, a physiologist, and architects and engineers with experience in programming, energy conservation, and building diagnostics.

Three government buildings in Canada's western provinces were studied. Two were office buildings and one combined offices and laboratories. We reviewed plans and specs, operating data from the control systems, and service and maintenance data. In walking through the buildings, we could see evidence of user problems. There were covers over some of the grilles, artificial barriers for privacy, no smoking signs, and baffles over lights that produced glare.

The intent of the study was not solely to determine air quality, occupant habits, or physical deterioration, but to look at total building performance—how one or more individual determinants might affect the others.

Fisher: What were some of your findings and recommendations?

Dubin: We often found that air patterns were not as shown on the drawings, and that there would be a lot more air coming out of certain outlets than shown. Control systems were not always fully utilized for energy management—they were primarily an extension of one individual manipulating the controls as he perceived temperatures. We found a lot of conservation measures, such as shutting off fan and exhaust systems at night, which saves energy but which may have exaggerated indoor pollution. In the combined office and laboratory building, there were higher levels of carbon dioxide and some cross-contamination among floors in the building.

The Department of Public Works is doing further testing: pressurization tests to determine the quantity of air changes, sampling of air distribution with tracer gas, and infrared photography to locate patterns of infiltration.

Major factors of indoor pollution

Dubin: While their findings are not yet conclusive, we can identify some of the major factors that contribute to indoor air pollution. There are the short-circuiting of the ventilation air flow, the improper maintenance of fluorescent lights, the failure to test soils for their radon content, the use of contaminating materials and products without proper ventilation and safety precautions, the improper balance of air systems, partition layouts that create pockets of polluted air, the failure to have an initial ventilation period in a new building prior to occupancy or to plan a frequent flushing of the building's contaminants, the failure to isolate and ventilate noxious activities, and the failure to consider the microclimate's wind patterns or level of pollution when locating openings in a building or when designing its mechanical system.

There is more information on air quality available now than there ever has been, so there is a great deal of material to sift through. But there is still a long way to go.

Research yet to be done

Fisher: What research still needs to be done?

Dubin: We need to look at the synergistic effect of chemicals combining in the air and, as I mentioned before, at the health effects of long-term exposure to indoor pollutants. We need to look at how pollution affects building materials and how heat exchangers and natural energy souces affect pollution levels. Research into the improvement of diagnostic techniques and equipment is ongoing, but finding the exact relationship among the factors that affect air quality—the amount and distribution of air, the outgassing of materials, the activities of users—is very complex.

Sources of information

Fisher: Where can architects and engineers get more information on the subject, and how can they become more involved?

Dubin: They can write to the Lawrence Berkeley Labs (1 Cyclotron Road, Berkeley, Calif.) or to ASHRAE or ASTM for information. California's Department of Consumer Affairs (Room 500, 1020 N Street, Sacramento, Calif. 95814, $15) published *Clean Your Room, A Compendium On Indoor Pollution,* the National Research Council has a publication entitled *Indoor Pollutants* (available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA, 22161, #PB82180563, $40), and the Sandia National Labs has just published *Indoor Air Quality Handbook* (also available from the National Technical Information Service, #SAND-82-1773, $16.50).

The AIA chapter in New York City has a subcommittee on indoor air quality, providing architects with bibliographies and resource material. We've found a great deal of interest among architects.

There's a fair amount of research going on at the federal level, and states have begun to regulate and to restrict or ban the use of certain contaminating materials. While most of the court cases have involved manufacturers and not architects, there is a professional responsibility to become knowledgeable about the subject. It's not just a matter of changing designs or materials; it's a question of changing our perceptions about buildings. There's a growing movement; people are becoming aware of indoor pollution; they're getting involved and looking for answers.

Acknowledgment

We would like to thank Lisa Saurwein for her contributions to this article.

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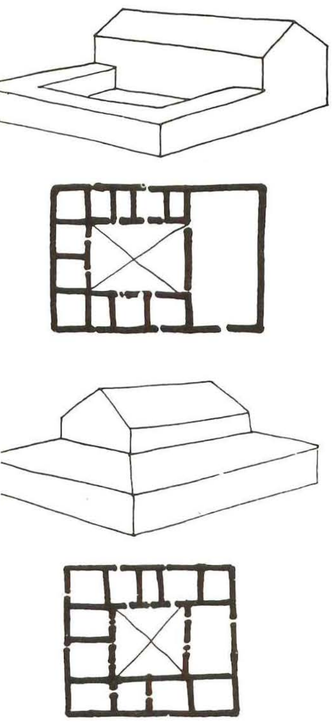
Post-industrial architecture

nergy-conscious design as as much to offer rchitectural theory as it oes building practice, much to offer the creation f form as it does the onservation of resources.



ne two dominant preindustrial ilding forms.

The year 1973 not only brought us the energy crisis; it marked, for architect Ed Mazria, the beginning of a post-industrial age. "For the first time as a people, we realized that resources on this planet are limited." The post-industrial age, in Mazria's view, will integrate the conservation of resources, which characterized pre-industrial societies, with the sophisticated technology of the industrial period. He sees that leading to a greater use of pre-industrial building forms which, in order to maximize natural light and air, used two basic strategies: the narrow plan, with floor widths ranging from one-and-one-half to two times the height of a room, and the large, central space, with lower dependencies and operable windows on all sides. It took the technological developments of the 19th Century to free buildings of their reliance upon natural light and air, and to free architects of pre-industrial forms.

We paid a price, though, for that freedom. With the industrial age came a dependence on the engineer, a preoccupation with style (since technology could construct and condition almost any form), and a heedless exploitation of natural resources. That exploitation also affected human resources. As Mazria puts it, "We created static interior environments that looked and felt the same day and night, winter and summer, thinking that we would get greater productivity out of people. Studies have shown that not to be the case."

The goal of post-industrial architecture, to use Mazria's terms, would be to optimize rather than maximize our physical resources. It would use advanced technology to conserve limited energy and materials, to give the architect greater control of the building process (by better understanding and predicting building performance), and to create more varied working environments. Post-industrial architecture might not look much different from the architecture of the industrial period. "It will be a major form change, not a style change, for it can encompass any style." By a form change, Mazria means that we will return to the narrower widths and higher central volumes of pre-industrial architecture, although the placement, design, and detail of those forms will be more precise because of our greater understanding of climatic conditions and our greater computational abilities available through computer systems. "Building forms will become more complicated because we will know more about them and what goes on inside them. We'll be able to manipulate them with a lot more information."

Not surprisingly, the work of Mazria/Schiff & Associates follows no one style. It takes its visual cues from adjacent buildings and uses local materials, which Mazria sees as part of a "new regionalism" where decentralized, sustainable communities might produce many of their own building materials and components, thus reducing transportation costs and increasing local employment. That has resulted, in Mazria's case, in buildings that are as unobtrusive in their context as they are conservative in their architectural expression.

Post-industrial architecture

By judging appearances, though, we misconstrue Mazria's intentions, for his ideas most clearly emerge in the form and details of the firm's buildings. Two projects, the Trust Pharmacy in Grants, N.M., and the Mt. Airy Public Library in Mt. Airy, N.C., summarize the basic tenets of post-industrial architecture. The buildings employ the two dominant pre-industrial forms: the narrow plan or the high, central room. They use facing materials either locally manufactured or commonly used in their communities. And they practice energy conservation through a variety of methods, derived not from sophisticated computer modeling, but from Mazria's more intuitive design approach, which uses the computer "as a check upon what we already knew was going to happen."

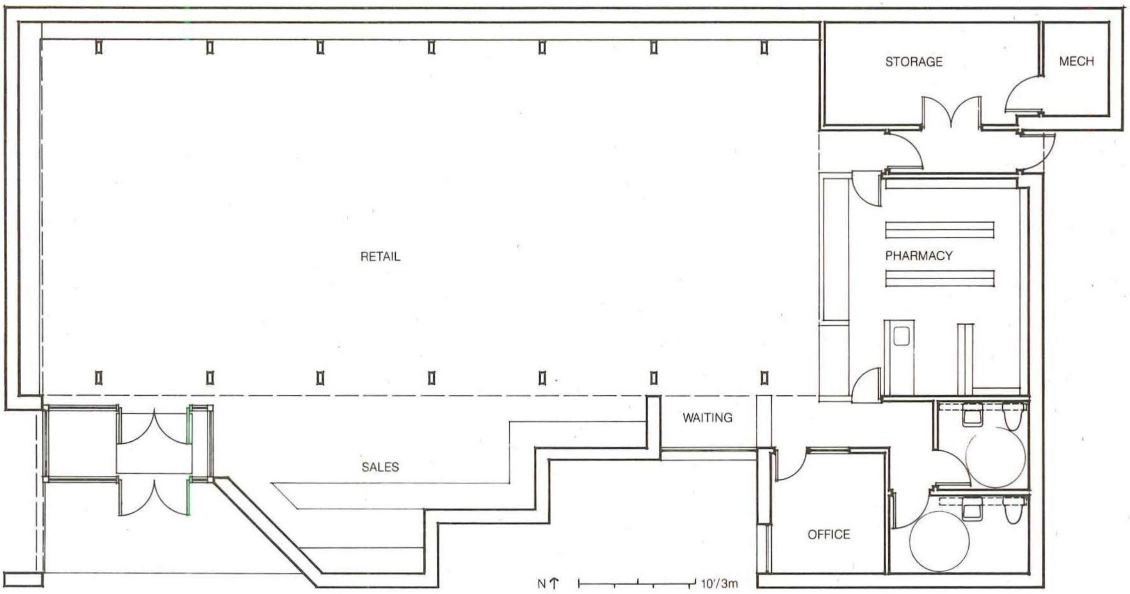
Trust Pharmacy

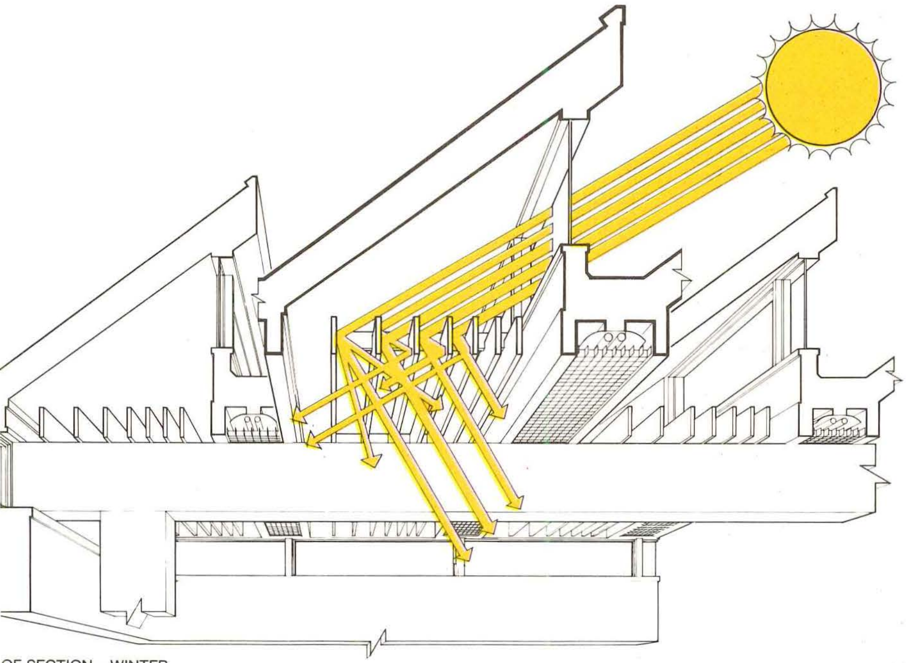
The Trust Pharmacy, located along a commercial strip in a small mining town in northern New Mexico, has a large, rectangular retail sales room abutted on two sides by lower subsidiary spaces. The north, east, and west walls have virtually no windows, while the south elevation has glass only at the entry and waiting area. Most of the pharmacy's interior lighting comes from a series of south-facing sawtooth skylights, which run the entire length of the sales room, giving customers the sense of being outdoors, under a canopy of trees, in direct contrast to the sense of enclosure provided by the fluted, concrete block walls. Two perimeter rows of laminated wood columns and beams support the skylights. The beams extend beyond the columns to rest on the block bearing walls, framing

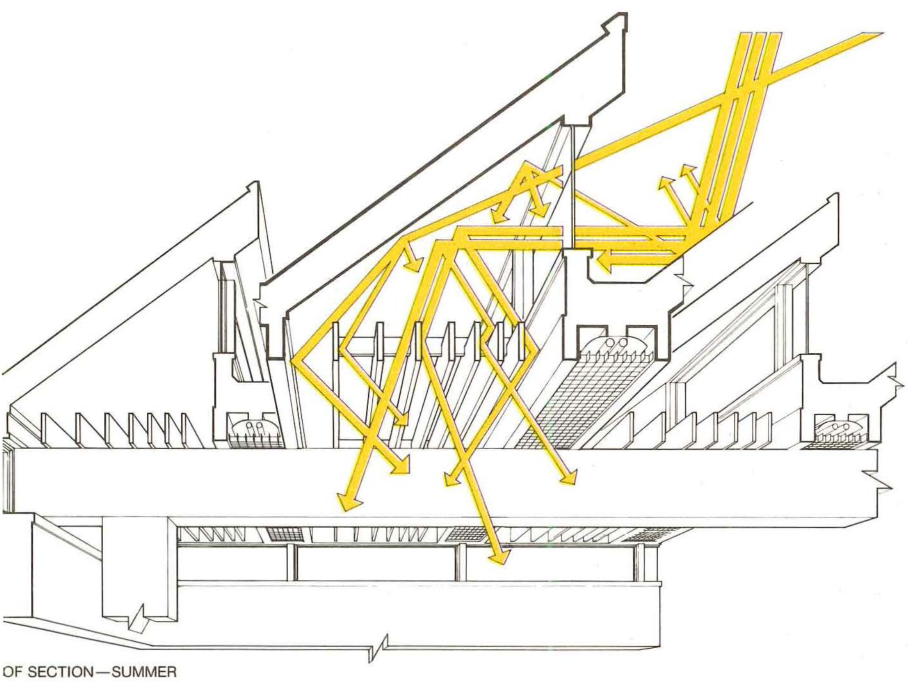

trust
PHARMACY


FARBERWARE
FARBERWARE
FARBERWARE

he closed exterior of the Trust harmacy (left above), to promote thermal lag and to reduce lar gain, makes the daylit interior (left below) a pleasant surprise. The sawtooth skylights, th their wood baffles (below), ffuse the light entering the reil sales area (right). The clerestory windows between the glue-minated beams, which let in rect sunlight in winter to heat e concrete floor and block walls, inforce the preindustrial spatial ncept of a single, high volume.




OF SECTION—WINTER


OF SECTION—SUMMER

clerestory windows, which reinforce the idea of a high, central space. The clerestory windows let in sunlight to warm the concrete floors and block walls in winter, while the thermal mass of the exterior walls keeps inside temperatures down in the summer, and the skylights provide an evenly diffused light year round. The diffusing mechanism in the skylights is a series of unevenly spaced wood slats, which block all direct sun angles. At night, fluorescent fixtures with eggcrate grilles illuminate the retail space from recessed housings between the skylights. The ancillary rooms also have artificial illumination, although the sales counter and office receive sufficient natural light during the day.

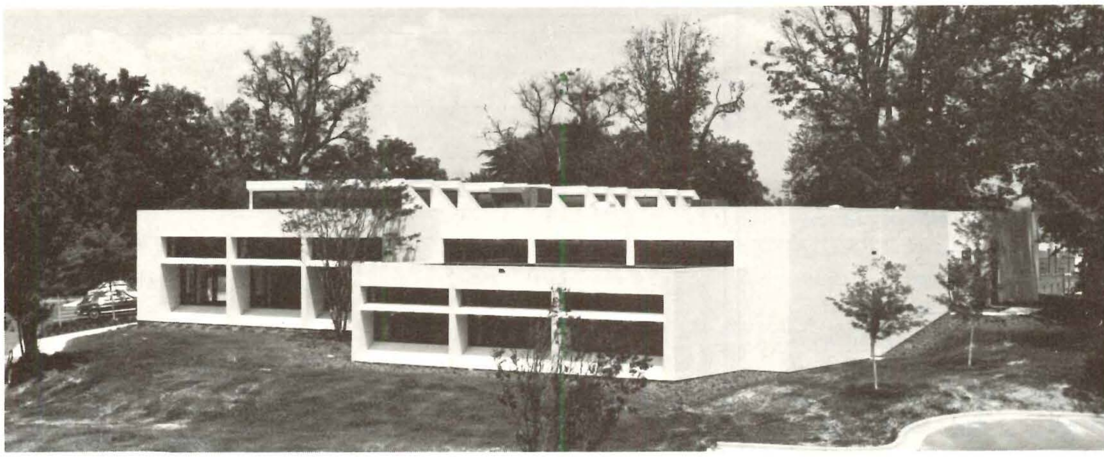
The building performs quite well. Its thermal mass allows the gas-fired heating system to remain off except for the coldest winter mornings, while the building's daylighting reduces the cooling load enough to permit the use of a low-energy evaporative cooler. The daylit pharmacy has an interior footcandle level comparable to an artificially lit drugstore nearby, for a fraction of the cost.

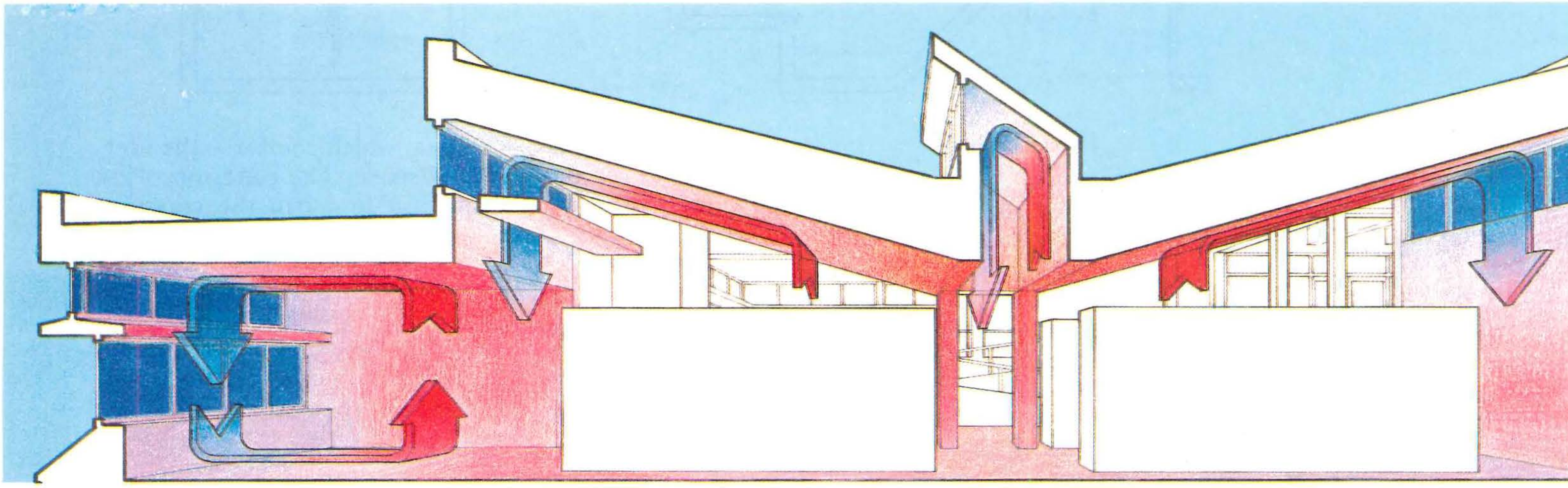
Mt. Airy Library

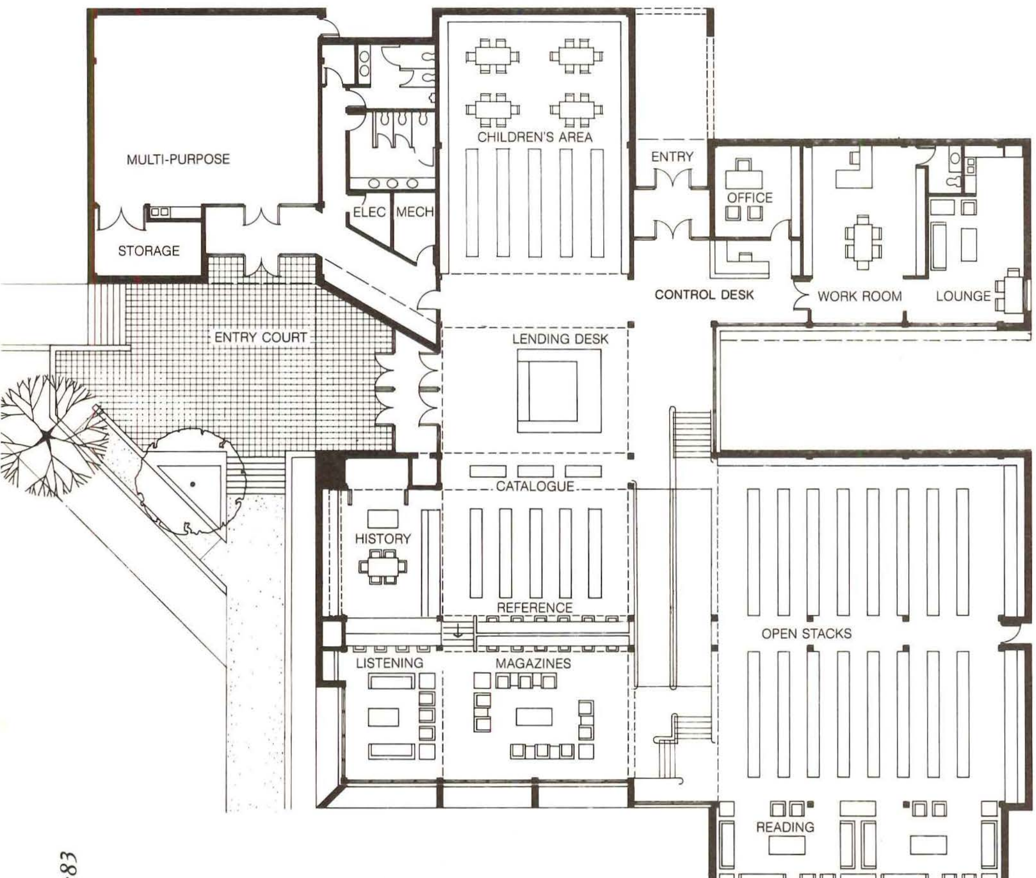
Another building type that some think impervious to passive design strategies is the public library, because of the high light levels required for reading and the humidity control needed for the maintenance of books. Mazria/Schiff & Associates and J.N. Pease Associates of Charlotte, N.C., have proven that assumption wrong in the Mt. Airy Public Library. Sited on three acres near the center of Mt. Airy, N.C. (which is noted for its locally quarried white granite), the 14,030-square-foot library had, among its constraints, the preservation of several large oak trees along the northern edge of the property, and visual integration with a new municipal building to its southeast. The library's plan combines a radial organization, with the person at the central circulation desk having visual control of every section of the building, and a layered organization of alternating 4-foot- and 24-foot-wide structural bays. The latter run in an east-west direction, with skylights located above most of the wide bays and mechanical runs, hidden by wooden slats in most of the

Library, Mt. Airy, N.C.

Post-industrial architecture will require new graphic techniques, such as Mazria's thermal section (below) of the library. The plan (below) features a series of narrow bays oriented south. The style of the library (above right and opposite) is unassuming, with its exterior using locally available materials.







narrow bays. The library shows the potenti conflicts that can arise between a building program and pre-industrial forms: Its si and program did not allow either a narro linear form or a single high volume. But l layering the concrete structure into narro skylit bays, the architects brought natur light and air to the large floor areas require for stack and reading areas.

The library's exterior consists of flame-c Mt. Airy granite with recessed windows ar entrances and a parapet that encircles tl building, concealing the skylights, solar co lectors, and heat pumps on the roof. The e terior treatment generally follows that of tl adjacent municipal building. A small e trance plaza, off the parking lot, gives acce to the circulation desk at the hub of the buil ing and to the multipurpose room, which ca be isolated from the rest of the library f nighttime meetings. Another recessed ent at the north elevation lies at the end of t major north-south circulation spine, whi has a complex set of switch-back ramps ar stairs that give access to the magazine, stac and reading areas as they step down the sit southern slope. The circulation spine sep rates two daylit zones within the buildin One zone, running north-south, contains series of sawtooth skylights that illuminate t circulation desk, reading areas, and referen stacks; the other zone, running east-west, h a butterfly roof with glazed ends and a centr light trough that illuminates the open stack Those stacks have a fluorescent light grid a tached to the upper shelves, which loo cumbersome and which produces an anno ing glare when viewed from the upper lev

The library offices have their own wing long the north side of the building, enclosing a courtyard used for children's story ours. With large, south-facing windows and orth-facing transom lights, the office wing eceives ample daylight. Less fortunate in hat regard are the children's reading area nd local history room—their lack of skylights nd paucity of windows requires artificial illumination most of the time. The architects ould not justify the expense of skylights or dditional windows in those little-used areas ven though, in an earlier plan, the children's eading and stack areas were reversed, with dequate natural light for both. Relocating unctions without moving the skylights above hows the close relationship of form and unction in passive design, where, unlike artificially controlled environments, a change in ne almost always requires a change in the ther.

The library's performance is impressive, evertheless. With Mt. Airy's hot summers nd mild winters, reducing the building's ghting and cooling loads became as imporant as heat-conserving strategies. The dayghting comes from the sawtooth skylights, ith their diffusing slats, and from the butrfly roof, which has a reflective light shelf in ont of the south-facing glass to cast light nto the white sloping ceiling. Light shelves so act as transoms along all south-facing indows to shade the vision glass in summer, reflect light onto the ceilings, and along ith horizontal blinds, to reduce glare. The nall amount of glazing, only 12 percent of e gross floor area, belies the amount of atural light in the building.

Passive cooling was achieved in three ways. Shade trees and the light-colored membrane roof reduce the effect of solar radiation. Operable windows enable natural ventilation, and thick exterior walls, with 12-inch concrete block and 3 inches of granite, provide enough thermal lag to delay the effect of the daytime summer sun.

The walls, as well as the tiled concrete floor slab, store heat that enters through the south-facing windows during the winter months. Although passive means provide much of the library's heating and some of its cooling, there is a five-zone, air-to-air heat-pump system as backup. Its programmable thermostat has an economizer cycle, an override switch for unscheduled meetings, and a staggered morning startup to avoid a power surge during peak demand. Computerized monitoring equipment records an energy consumption of 17,069 Btu/sq ft/year which, even when adjusted for the Resource Utility Factor of 3.08, is well under the BEPS of 106,000 Btu. Two nearby buildings of approximately the same date and size use almost three times as much energy as the library.

Ed Mazria admits that the Trust Pharmacy and the Mt. Airy Library do not hold the final "answer to post-industrial architecture. That is going to happen over a long period of time, just as industrial architecture developed over 150 years. We're just seeing the early signs of what is possible." For that possibility to become a reality depends, in part, on our separating the issues of form and style, on our distinguishing between post-industrial architecture and the styles of Post-Modernism. [Thomas Fisher]

Data
Project: *Trust Pharmacy, Grants, N.M.*
Architect: *Mazria/Schiff & Associates, Albuquerque, N.M.*
Client: *Diamond 'G' Trust.*
Site: *flat, high desert with severe winters and hot summers.*
Program: *a 3420-sq-ft store with south exposure to maximize daylighting.*
Structural system: *concrete foundations, block bearing walls, glue-laminated post-and-beam structure.*
Mechanical system: *gas-fired heater, electrical evaporative cooler.*
Major materials: *(see Building materials, p. 176).*
Consultants: *Engineering Associates, Albuquerque, N.M., structural.*
General contractor: *Andrew Mirabal.*
Cost: *$150,000; $43.83 per sq ft.*
Photography: *Jerry Goffe.*

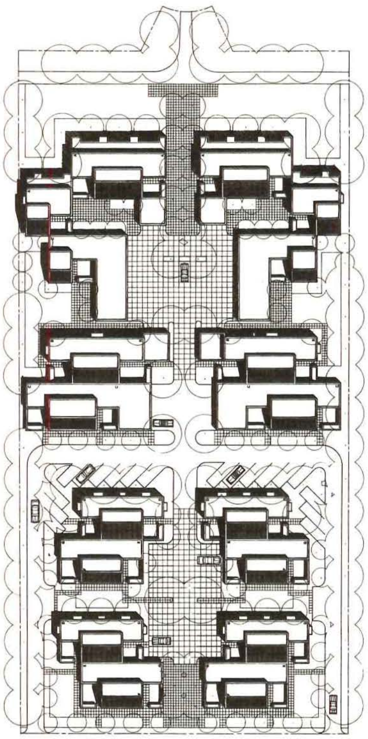
Data
Project: *Mt. Airy Public Library, Mt. Airy, N.C.*
Architects: *Mazria/Schiff & Associates, Albuquerque, N.M.; Edward Mazria, Marc Schiff, design team; J.N. Pease, Associates, Charlotte, N.C., Tony Ansaldo, project architect; Gary Morgan, project manager.*
Client: *City of Mt. Airy, N.C.*
Site: *three acres with south slope toward view, located between a residential area and the city center, next to the municipal building.*
Program: *14,030-sq-ft library including stack, reading, and office areas and a multipurpose room.*
Structural system: *cast-in-place concrete foundations and structure, concrete block walls, steel roof framing, metal deck.*
Mechanical system: *electric air-to-air heat pumps with economizer cycles, constant air volume distribution with strip diffusers, electric hot water with solar pre-heat.*
Major materials: *(see Building materials, p. 176).*
Consultants: *Design Environments, Inc., interiors.*
General contractor: *John S. Clark Co., Inc.*
Cost: *$1,361,960; $97.07 per sq ft.*
Photography: *Gordon H. Schenck, Jr.*

Pajaro Solar Housing,
Davis, Calif.

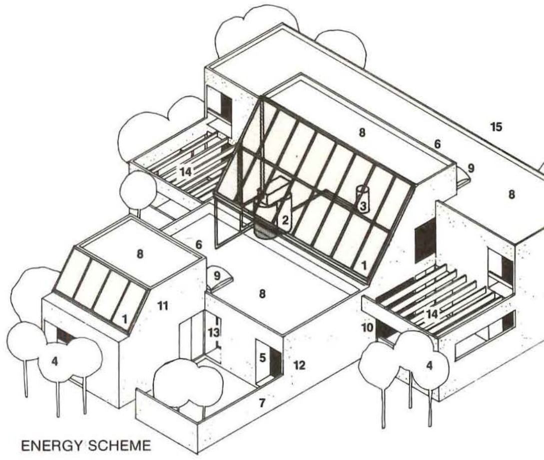
Planning wisdom for an energy-wise town

Sally Woodbridge

Architect Sam Davis incorporates active and passive solar features in Pajaro, a housing project in Northern California, while considering the spatial implications of clustering units.



N ↑ 100'/30m



ENERGY SCHEME

1 Water type solar collectors
2 Solar storage tanks
3 Domestic hot water tank
4 Deciduous trees provide summer shade
5 Recessed south facing windows
6 Clerestory windows for light and ventilation
7 Wingwalls provide wind protection
8 12″ grey roof gravel insulation equalizes heat transfer
9 Skylights
10 All double glazed windov
11 6″ wall insulation
12 White stucco reflects hea gain
13 Protected south entranc
14 Trellis provides East-Wes shading
15 Minimal north windows

In Davis, Calif., motorists cower before fleets of bicycles. Roofscapes of solar collectors are commonplace. Davis proudly calls itself the nation's energy conservation and bicycle capital: Since 1974 an energy conservation building code has mandated south orientation and light-colored walls and roofs, imposed standards for insulation, and restricted exterior glazing, giving credits for various kinds of shading and screening.

Not only are Davis's builders used to working with a variety of energy strategies, but some are also engaged in manufacturing active energy systems. One such is Tandem Properties, Inc., allied with Trident Energy Systems, the client for the Pajaro solar housing project. Using the Trident system was one of the project's requirements.

Sam Davis, Pajaro's architect, had worked with the system before. Water from the collectors is stored, mixed, and circulated through a concrete floor slab, and each dwelling has its own storage tanks and computer controls. The system requires that the area devoted to collectors equal 20 percent of the floor area of the unit, with benefits in proportion to the amount of floor area on grade. Dealing with the visual impact of long stretches of rooftop collectors provides a formidable design challenge, compounded in this case by the program, which required that 36 dwellings—in a mix of studios and one-, two-, and three-bedroom units ranging in size from 500 to 2500 square feet—be sited on three flat acres with a parking ratio of 2:1. Fifty percent of the parking was to be enclosed.

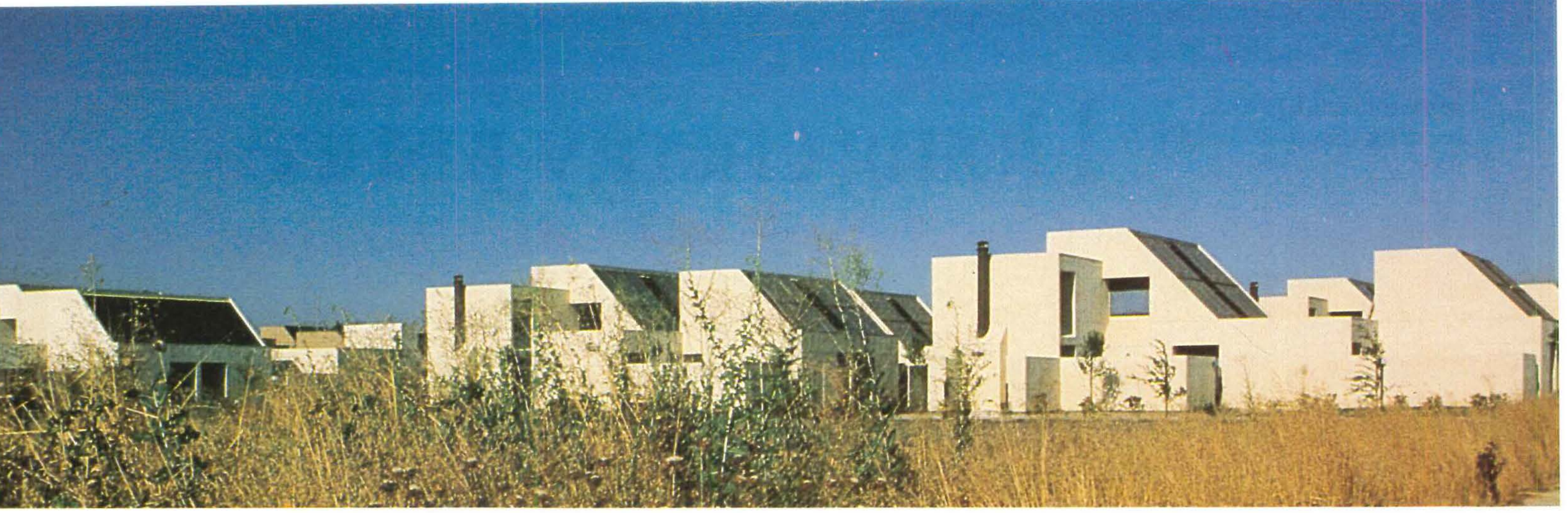
The design process began with the decision to give each dwelling a square plan composed of smaller squares, one of which would serve as a private, walled entry court. The dwellings were then organized in two clusters: a front cluster based on four 16′ x 16′ squares, and a back cluster based on four 18′ x 18′ squares. Stepping the units in and out on the site provided both compositional variety and central plazas that double as open space and parking, while a strong streetscape and varied rhythms were created by placing the cluster of smaller units at the front of the site.

The little space that remained after the dwellings and cars were accommodated was carefully planned for pedestrian passage between them. The pleasant and practical nature of these transitional spaces results from the skillful arrangement of the clusters, which permits a variety of vantage points as well as clear orientation. The use of unit paving ir stead of asphalt also distinguishes th pedestrian/vehicular zones. The only aspha surface in the project is a narrow service roa that loops around the front cluster, giving a cess to diagonal parking and the inner cour

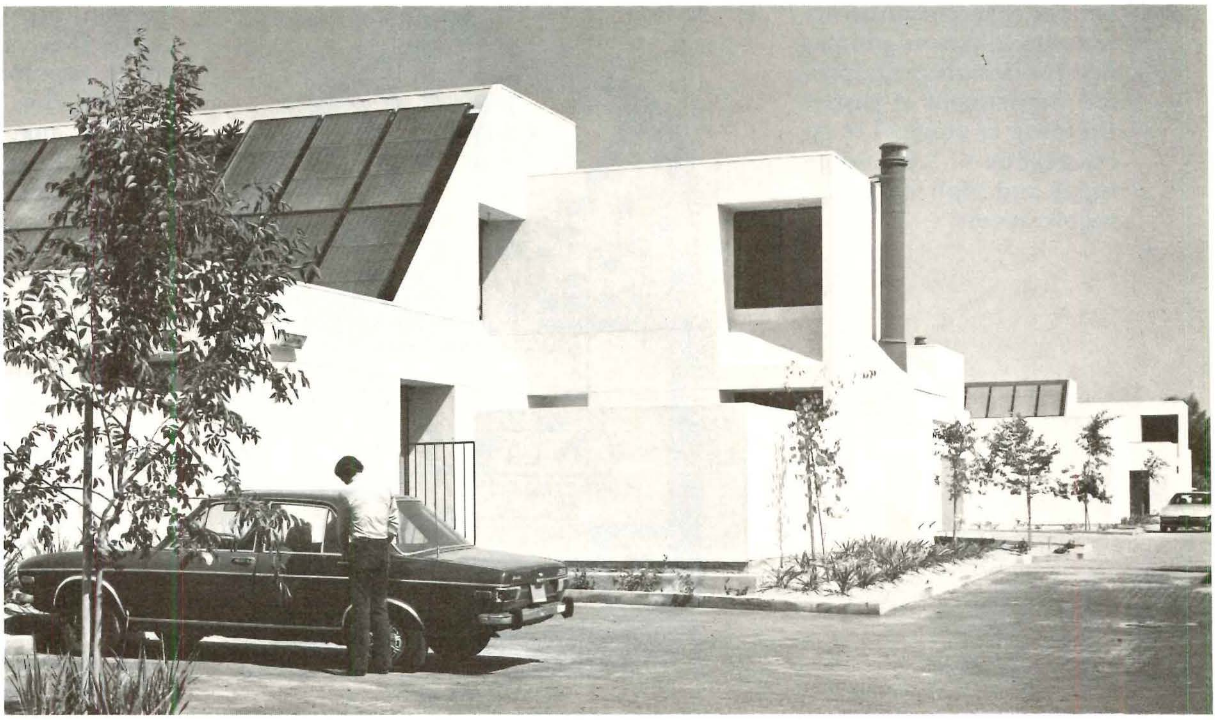
The placement of parking space within th Pajaro is a departure from the usual plannir principles applied in housing projects i Davis. Although it may be argued th peripheral parking bays give residents th chance for interior landscaping, it is also tru that they create an initial impression of closed compound screened by fringes of car At issue are urban design considerations th so far have not been deemed important Davis.

Over the last decade, the edges of Dav have been steadily converted from open fiel to housing. The resulting superblock d velopments have discrete site plans, most which are based upon independent road sy tems. A relatively uniform building heig furnishes the only continuity from one tra to the next. In this generous but banal subu ban landscape, Pajaro shines forth as a "s piece," a singular triumph over program co straints and an undistinguished conte Here, the feeling of expansiveness com from the quality, not the quantity, of space.

Sally Woodbridge, *a contributing editor to P/A, is an architectural historian, lecturer, and coauthor of several books on California architecture.*



'he strong geometry of Pajaro's
ight-colored, stuccoed units
above) is generated by a tight
;eometric plan. The stepped units
reate central plazas (right), and
ecessed south-facing windows
ncrease the plastic effect of the
valls. Interiors (below, far right)
ave high spaces with lofts
ighted by clerestory windows
vith operable sash for cross venti-
ation. Greenhouses (not shown)
n the north elevation invite the
vinter sun, and may be screened
ff with movable shades.

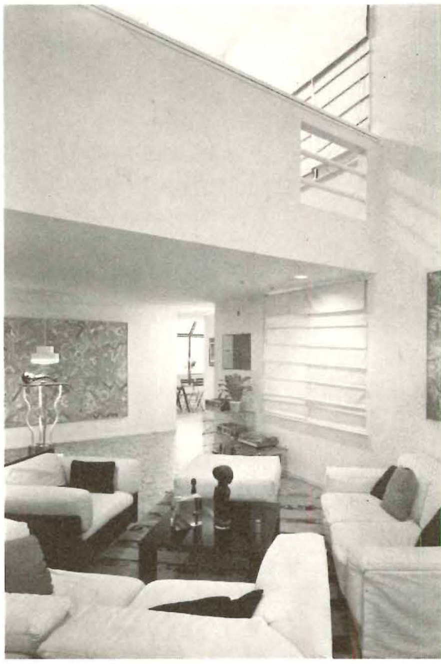


Data

Project: *Pajaro Solar Housing, Davis, Calif.*
Architect: *Sam Davis, Architect, Berkeley, Calif.; R. Heapes, R. Remiker, M. Quattrocchi, assistants, Vladimir Bazjanac, consultant.*
Client: *Tandem Properties, Inc., Davis, Calif.*
Site: *three flat acres.*
Program: *36 units, 500–2500 sq ft; 2:1 parking ratio; 50 percent enclosed.*
Structural system: *wood frame, concrete slab-on-grade.*
Mechanical system: *individual solar collectors, storage tanks, computer controls. Slab, containing water pipes, serves as thermal mass for radiant system.*
Major materials: *exterior, stucco; interior, gypsum board; floors, wood, ceramic tile, vinyl tile, carpet (see Building materials, p. 176).*
Consultants: *Paul Deering, Landscape Architect; David A. Crane & Associates, structural; Trident Energy Systems, mechanical; Larry Somerton, technical development.*
General contractor: *Tandem Properities, Inc.*
Cost: *$45.97 per sq ft, including site work.*
Photography: *Rob Super.*

STUDIOS

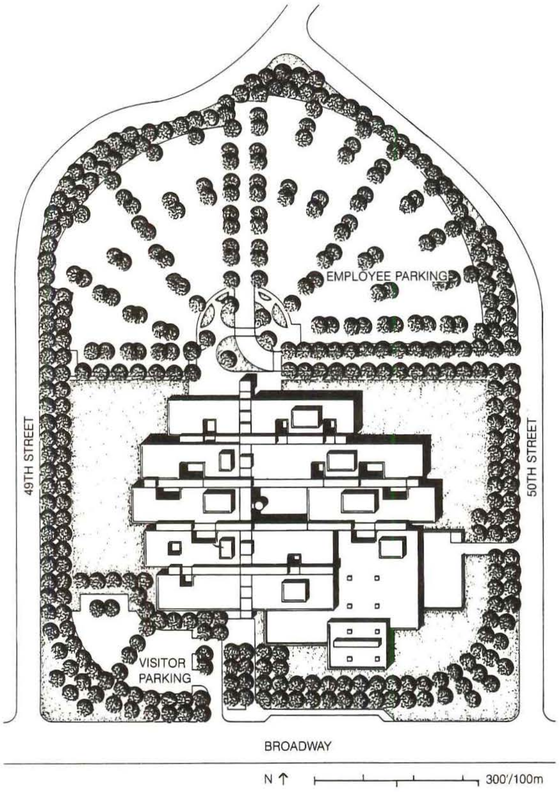
TWO BEDROOM UNIT



Department of Justice Building, Sacramento, Calif.

Doing energy justice

One of several California state buildings employing passive design principles, the Department of Justice Building is unusual in its integration of low energy usage and high security requirements.



Not every building lends itself to resource conservation. The California Department of Justice Building in suburban Sacramento, designed by Marquis Associates, had such strict functional and security requirements that meeting the state's energy consumption standard of 75,000 Btu per square foot per year seemed formidable. For example, the exhaustive program written by architect Bobbie Sue Hood for the state emphasized user control of the building. The program went beyond enumerating the size, use, and relationship of various functions; it stipulated organizational and design criteria, such as having clear entrance and circulation systems, individual climate controls, office clusters of between 12 and 24 workers, a horizontal relationship among departments, and access to outdoor spaces. It also described the security needs of the Justice Department. With crime labs, files, and computer equipment, as well as offices and classrooms for the state's crime-prevention programs, all located within one building, the department feared criminal attacks against the structure or against people entering or leaving. The Justice Department wanted a design, essentially closed on the exterior, with a minimum of horizontal or verti cal recesses (to prevent the hiding of bombs and maximum visibility of entrances an parking lots.

The potential conflicts with the state' energy standard quickly became apparen How could the architects daylight the build ing to reduce power demand and heat gai without allowing a view from the outside How could they ventilate the structure to re duce cooling loads without having operabl windows? How could they humanize the facil ity, with employee access to the outdoor without jeopardizing security?

Design solutions

Marquis Associates solved those conflicts wit considerable finesse, turning the building in ward, with a series of courtyards and double story corridors. The required clarity of en trance was met with a broad concrete wal that leads from the road, past the public park ing, to a two-story porchlike concrete struc ture that extends beyond the one-story reflec tive glass entry. The same treatment occu on the other side of the building, where th employees' parking is arranged in a radia pattern to allow surveillance from the guar station just inside the doors. The radial park ing is contained within a ring of eucalyptu trees and earth berms that effectively shiel the building from the surrounding residen tial neighborhood.

The Justice Department Building reflec the concerns of the client with its fortresslik appearance from the road. The most prom nent façade contains windowless compute mechanical, storage, and loading dock are built during a first phase of the project. Th second phase of offices offers only narro slits of reflective or tinted glass, interrupte by two-story recesses of reflective glass mar ing the location of the building's corridor The building is clad in a scored reddis stucco, which was not the architect's fir choice of unglazed quarry tile, but which w necessitated by budget constraints.

A "main street" bisects the building, co necting the two entrances. At right angles t that spine, every 72 feet, extend transvers corridors with glass end walls to accomm date future expansion. The corridors are 1 feet wide with 8-foot-wide second-floor wall ways, topped by double-glazed and reflecti glass clerestories that bring daylight into th center of the building and give a spaciousne to the tightly packed plan. The corrido

ɔnnect several small "neighborhood" court-ards and wrap around a large, open-air town square." Those courts not only bring ght and air into the non-air-conditioned ɔrridors and allow employee access to the utdoors without moving beyond the security uards, but also identify the entrances to the 2 bureaus housed within the 350,000-quare-foot facility. The architects' reference ɔ the courts as neighborhoods and the cor-idors as streets is not inappropriate. The size and scale of those spaces, within a secure exterior wall, has the character of a fortified European village.

Energy details

It is in the details of its energy-conserving strategies as much as in its plan that the Justice Department Building stands out. The exterior walls along the north and south elevations have an ingenious section, with a narrow band of reflective glass for the view of people seated at desks, a sloped white panel for reflecting daylight onto the ceilings, a recessed transom light with tinted glass and horizontal blinds to prevent glare, and an operable vent within the soffit for intake air

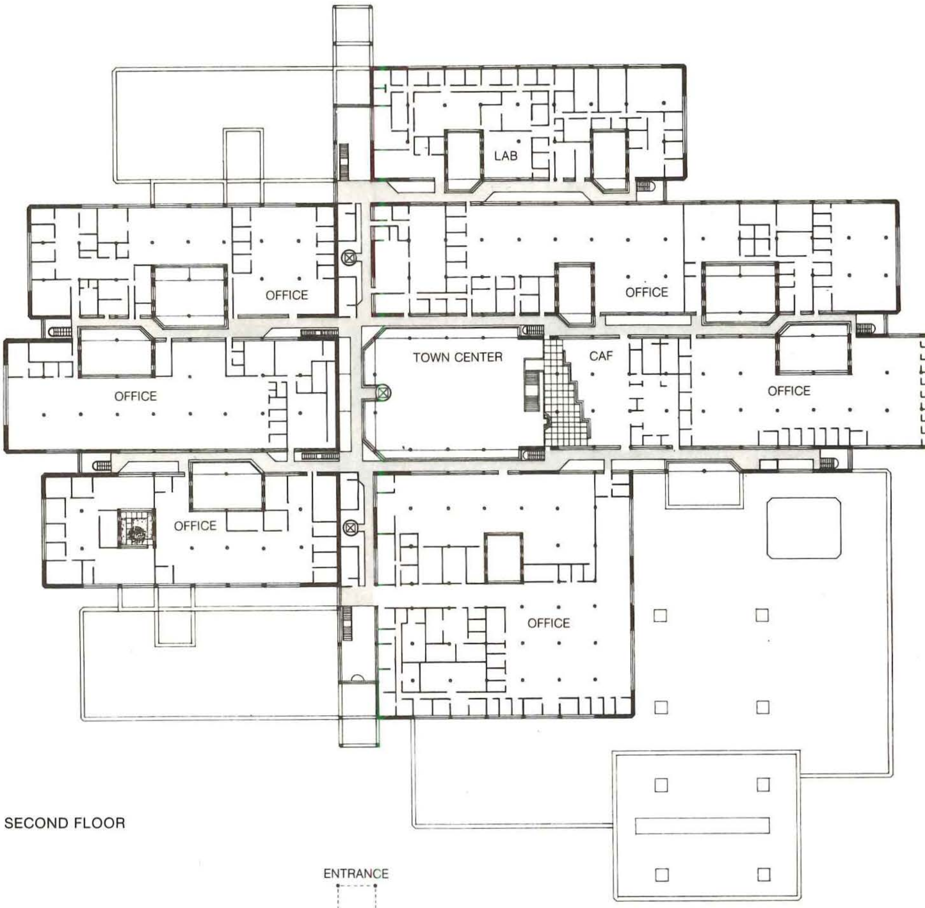
The concrete frame (top) that extends beyond the entrance to the building conveys the image of a front porch. The building's expandability, implied in the entrance's concrete frame, becomes even more clear at the east elevation (bottom) where office wings extend to different lengths between the regular interval of corridors.

serving the night air-cooling system. While the limited view when one is standing in the offices creates a certain claustrophobia, the exterior wall section acts as a compact and efficient environmental filter.

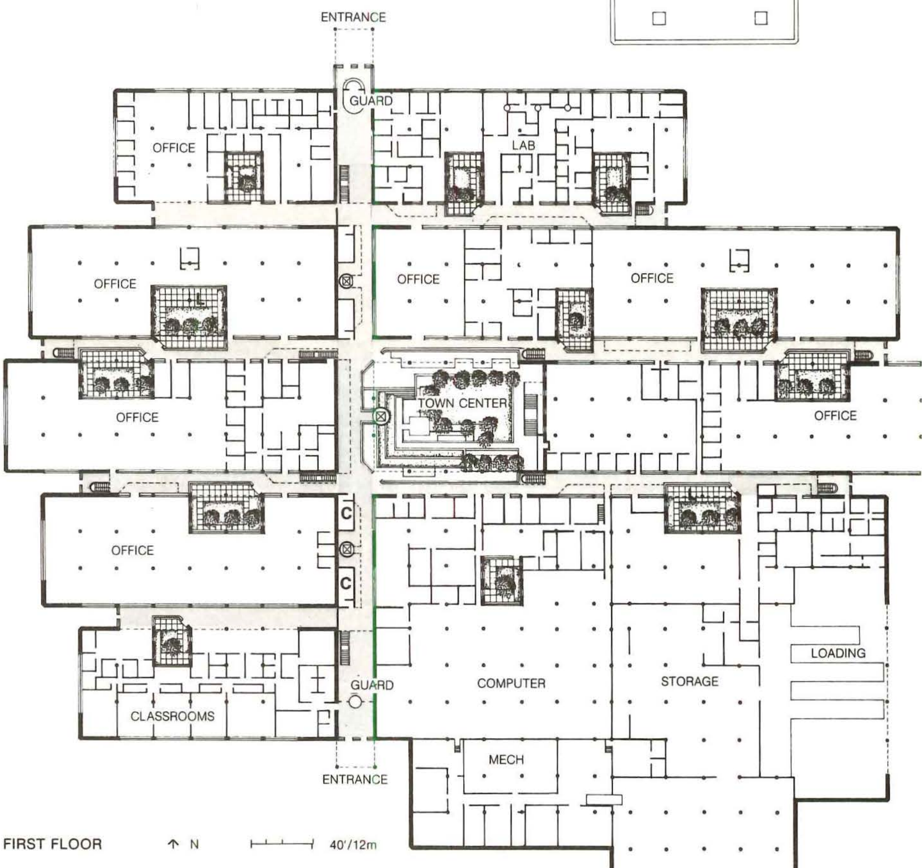
The night air-cooling system takes advantage of Sacramento's wide diurnal temperature swings to reduce the cooling loads and lower the courtyard temperatures. The building's concrete waffle floor slabs absorb the daytime heat generated by people, lights, and equipment. At night, low horsepower propeller fans, located in the corridor ceilings, pull cool air through the opened exterior soffit vents, under the slab to cool it, through transom vents in the corridors, and out barrel-vaulted louvers on the roof. Placing that air plenum above a suspended ceiling keeps the night air against the slab and prevents the rapid cooling of offices, allowing their 24-hour use. At a cost of $100,000, the night air-cooling system should pay for itself in 11 years, with an anticipated saving of $245,000 in energy costs over the next 20 years.

Not all of the heat generated internally in the building is exhausted through that system. The computer center's heated air passes through double-bundle condensers before being exhausted to make it available for domestic hot water (supplementing the 650 square feet of solar collectors on the roof), for space heating in winter, and for reheating the computer terminals in summer. A separate charcoal filter system allows the recycling of the toilet exhaust air.

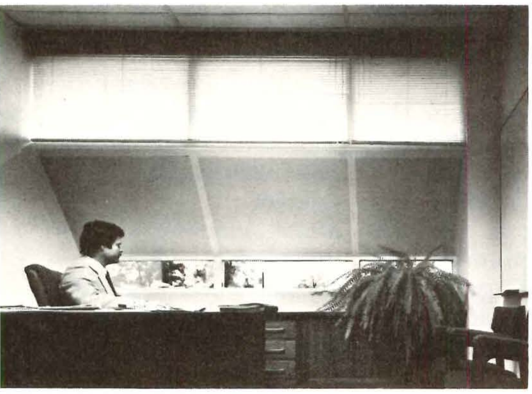
With water consumption and distribution a major political issue in California, the Justice Department Building uses low flow volume water fixtures. And with high electrical rates and peak demand taxing the generating capacity of utilities, the building employs several power conservation methods. Its air-conditioning refrigeration equipment operates at night at lower condenser temperatures; a concrete tank stores the chilled water for use the next day. With a budget of 1.5 watts per square foot, the offices use a combination of task and ambient lighting, with fluorescent task lights providing an initial 80 footcandles on dimmers so that individuals can make their own adjustments, and ambient lights that use low brightness paralume fixtures providing an initial 20 to 30 footcandles. The luminaire ballasts can give alternate intensities of 10 or 15 footcandles. Exterior and storage room lighting use low pressure sodium fixtures, with non-yellow high pressure sodium fixtures anticipated for the corridors. A computer switches lights in little used areas in addition to monitoring and controlling the HVAC system. Other equipment that reduces the power demand includes photocell controls, which operate fixtures near windows when sufficient daylight makes artificial light unnecessary; enthalpy and economizer controls, which reduce equipment operation during mild temperatures; variable air volume systems, which run at reduced capacity more than 85 percent of the time; chiller controls, which allow the temperature of the chilled water to change with load requirements; and variable-pitch axial supply fans, which use 40 percent less power than centrifugal fans. As juror Sital Daryanani said of the Justice Department Building after it unanimously won the Owens-Corning energy conservation award in the government-design category, "a lot of

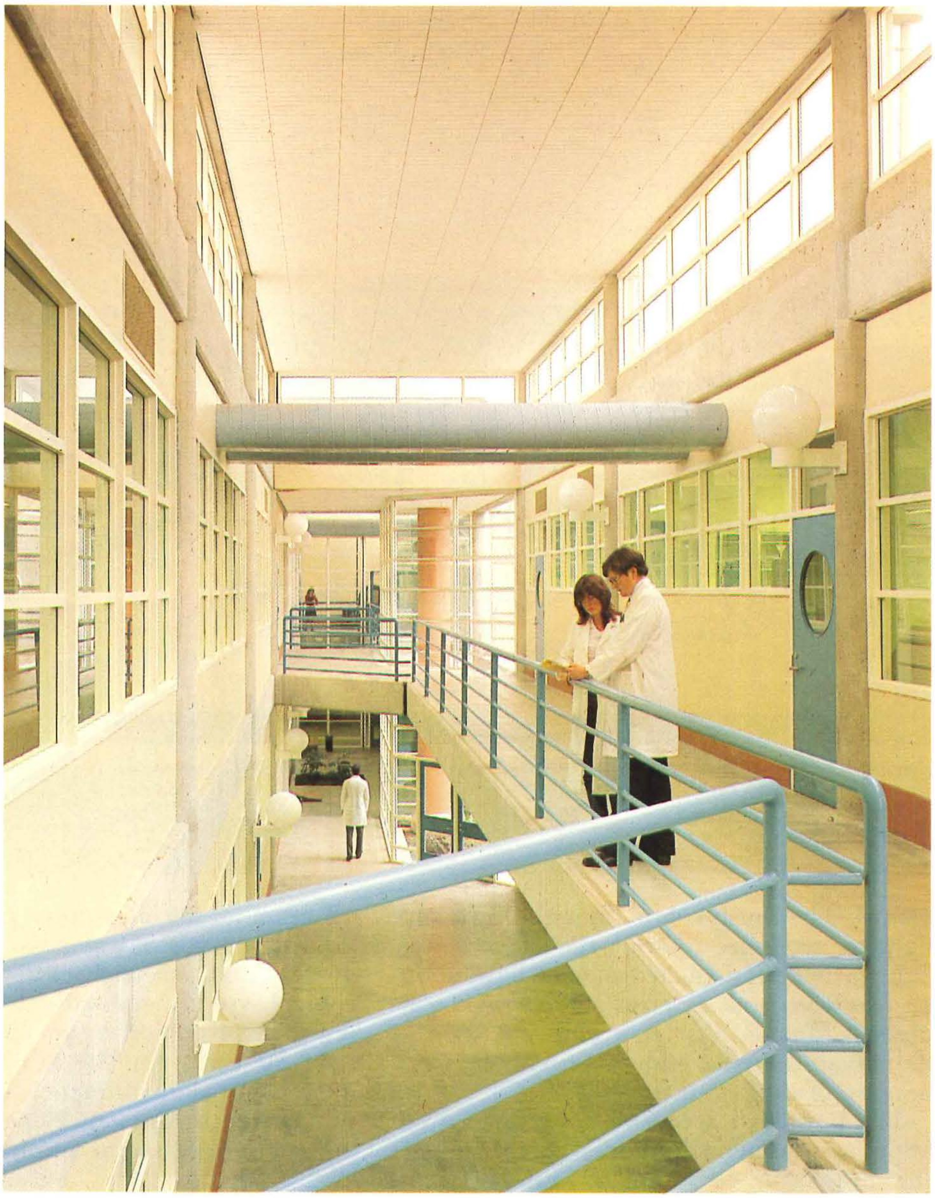


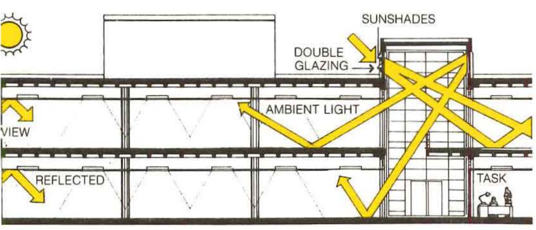
SECOND FLOOR



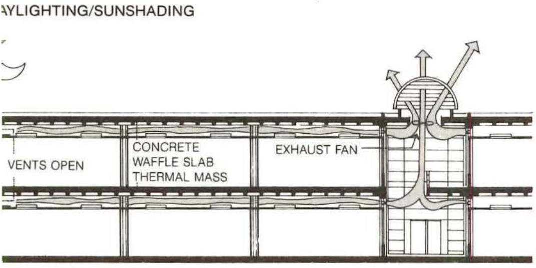
FIRST FLOOR N 40'/12m



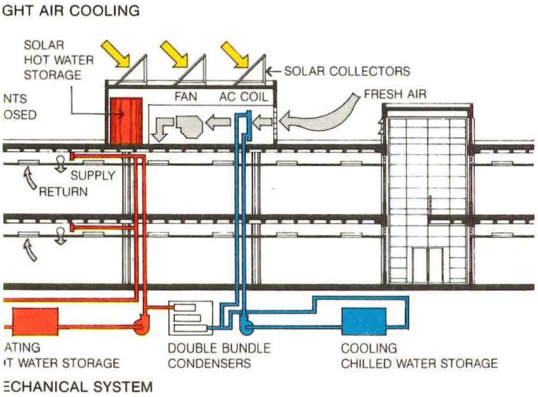




AYLIGHTING/SUNSHADING



GHT AIR COOLING



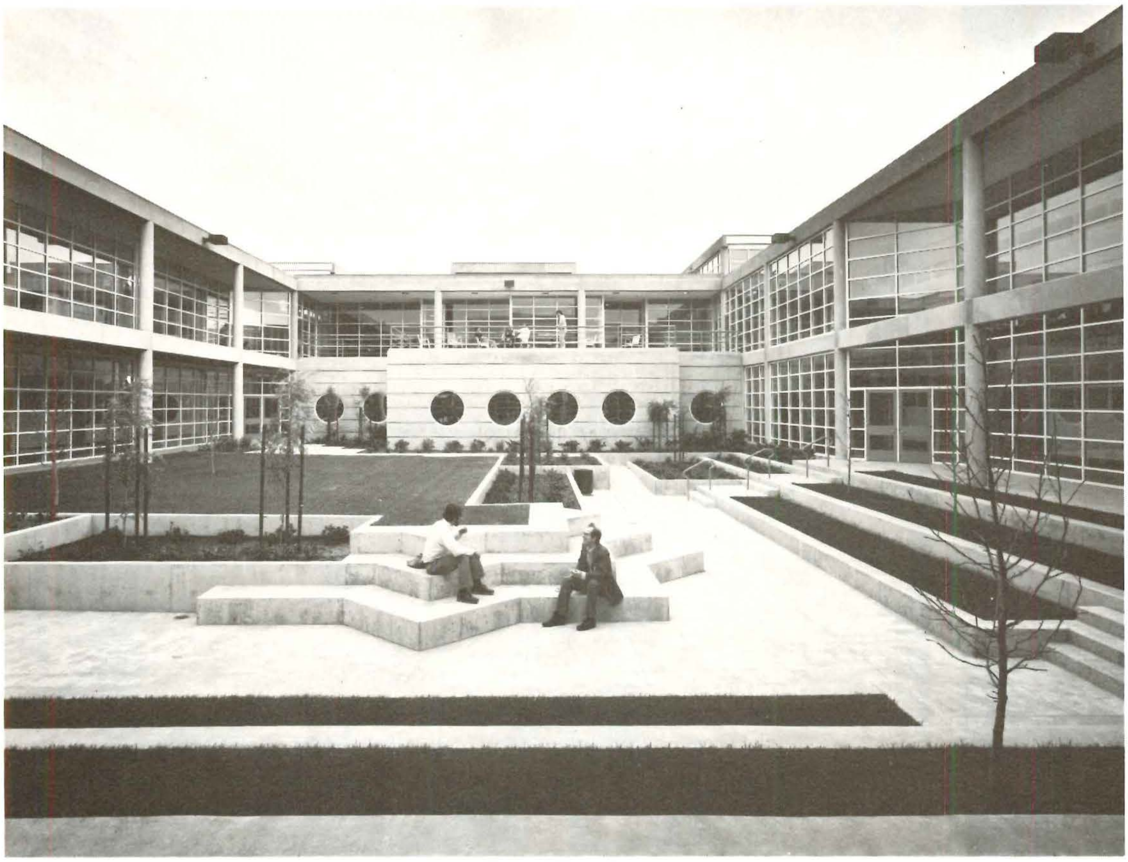
ECHANICAL SYSTEM

these systems have been developed and used in small prototype buildings. When you scale them up . . . with complex functions, and still keep the simplicity of those systems working, that in fact is an innovation in its own right."

Concrete shear walls stabilize the building against earthquakes. The architects decided to leave all shear walls exposed, scoring them with horizontal lines and, when located adjacent to a courtyard, punching circular windows in them to allow a view without disturbing their structural integrity. The scored lines unify several architectural components. Their horizontal dimensions locate the mullions in the glass walls, the head and sill heights for doors and windows in offices overlooking the daylit corridors, and least successfully, the height of colored bands that form wall graphics in some of the open offices.

Marquis Associates have some misgivings about the office interiors. A tight budget allowed only the simplest finish material and treatment. Except for built-in cabinets and a movable partition system designed by the architects and built by prison labor, the furniture came from previous Justice Department

The plans (opposite) indicate the size and complexity of the building, controlled by a clear and consistent circulation system. The exterior wall (above left) acts as an environmental filter for daylighting, ventilation, and glare (left), while the daylighted, unconditioned corridors (above) function, in part, as large return air ducts. Cool night air is drawn through the exterior soffit vents and, having absorbed heat from the concrete slab, is exhausted through transom vents and large fan housings in the corridors. The clerestories also provide diffused daylight through the interior office windows. The diffusing mechanisms include overhangs, exterior shades, and reflective glass.



The "town square" allows outdoor access without violating the building's secure perimeter.

offices. The finish colors, though, were kept light to maximize interior reflectance. Daylight provides adequate ambient light about 15 feet from both exterior and corridor windows; additional skylights were not used to illuminate the remaining artificially lit space because of their security risk.

The building's accessible courtyards, well-appointed cafeteria, and open corridors meet the program's requirements for social interaction. That openness, however, creates other problems. The double-height corridors make isolation of parts of the building difficult. To separate low- and high-security areas, a wall was built across one corridor, creating an awkward dead-end space. The openness also raises some fire code issues, solved by sprinklering the corridor, installing wire glass in rated frames in all corridor doors and windows, and using the corridor exhaust fans for smoke removal.

Obvious care was taken in avoiding solar heat gain. On the exterior, few windows exist on the east and west elevations; other windows have reflective glass or tinted glass beneath overhangs. In the corridors, building projections, external sun shades, and recesses keep out direct sun in the summer and allow it to bathe the concrete floors in winter. Rigid insulation, 3½ inches thick, and a light-colored roof prevent the concrete deck from overheating.

The building's anticipated total energy usage is 38,000 Btu/sq ft/year. Fred Dubin, the energy consultant on the project, thinks that the figure "could have gone to 25,000 had there not been such a tight budget." With 12 years as the maximum payback (for the solar domestic hot water system) and 3 years as the minimum payback (for the computer control system), and with an anticipated saving of $4.4 million in energy costs over the next 20 years for the entire building, the higher initial investment in energy-related systems (approximately 29 percent of the $26 million budget) seems amply justified.

Verdict pending

How the Justice Department Building actually performs and is received by employees remains a question. Will employee productivity be affected by the wider range of interior temperature or lighting levels? Will the architects' efforts at explaining the building's operation in the department's newsletter effectively counter any misuse of the energy systems? Will the building strike the balance, so difficult to achieve in offices, between automated and individualized climate control?

What is certain is that the Justice Department Building shows the positive effect conservation can have on architectural form, providing a basis for decisions that vary from fenestration details to the organization of the overall plan, without being visually obtrusive or physically inconvenient. The architects have given conservation a fair trial, judiciously weighing energy efficiency against equally important issues of security, productivity, and aesthetics. Where the building slips architecturally, in its somewhat disappointing interior and exterior finishes, it does so mainly out of budget constraints. Where it excels, in the ingenuity and breadth of its conservation strategies and in the humane, noninstitutional quality of its interior organization, it deserves careful deliberation. The jury of building users is still out, but the verdict looks good. [Thomas Fisher]

Data

Project: *Department of Justice Building, Sacramento, Calif.*
Architect: *Marquis Associates, San Francisco, Calif. Robert Marquis, principal in charge; James Caldwell, project architect; Phyllis Martin-Vegue, interior design; Robert Wulf, project manager; Gita Dev, Jacques DeBrer, John Ellis, Beverly Chiang, Bruce Bullman, Marc Toma, project team.*
Client: *Office of the State Architect.*
Site: *flat 24-acre site, formerly state fairgrounds, in low-rise residential neighborhood.*
Program: *320,000 sq ft including training center, crime labs, computer center, and record storage.*
Structural system: *cast-in-place reinforced concrete with waffle slabs and shear walls.*
Mechanical system: *VAV distribution, night air cooling, computer heat recovery, hot and cold water storage, solar hot water for cafeteria.*
Major materials: *(exterior) stucco and porcelain panels, aluminum window and door frames with thermal glazing, fabric and metal sun shades, exposed concrete, fiberglass insulation; (interior) gyp board walls, acoustical tile ceilings, sealed concrete floors (see Building materials, p. 176).*
Consultants: *CHNMB, landscape; Rutherford & Chekene, structural; Hayakawa Associates, mechanical; Engineering Enterprise, electrical; Dubin-Bloome Associates, energy.*
General contractor: *(phase I) R.G. Fisher; (phase II) Continental Heller.*
Costs: *$28,000,000; $73 per sq ft.*
Photography: *Peter Aaron, © ESTO.*

THE GE OPTIMISER LIGHTING SYSTEM COSTS MORE. BUT IT'S LESS EXPENSIVE.

ecifier Series No. 1

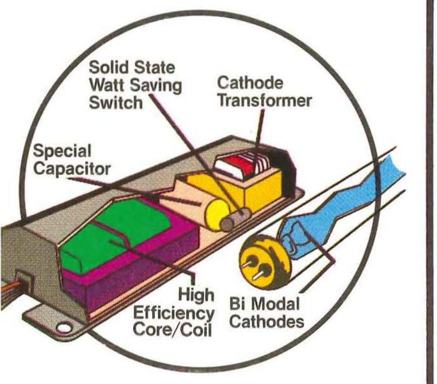
This new General Electric timiser lighting system combines ergy-efficient 28-watt lamps h specially-designed, brid solid state 2-lamp lasts to save % in energy ts com- red to ical ndard orescent tems. Yet, most fixtures, re is only a slight out 3%) reduction in maintained t levels.

TYPICAL 4-LAMP ENCLOSED TROFFER PERFORMANCE*			
PERFORMANCE MATRIX			
LAMP TYPE BALLAST TYPE	4-STANDARD 2-STANDARD	4-F34 ENERGY SAVING 2-ENERGY SAVING	4-OPTIMISER LAMPS 2-OPTIMISER BALLASTS
itial Lamp Lumens	3150	3050	2550
amp Life (Hrs.)	20,000	20,000	15,000+
allast Factor/ Thermal Factor	.95	.94	1.07
.U.	.75	.75	.75
LD (Mean)	.876	.876	.895
DD (Typical Office)	.732	.732	.768
atts/Fixture	176	137	116

Based on GE Tests

The performance-matched timiser lamps and ballasts in- ase system efficiency by 39%. A typical 4-lamp troffer with ndard lamps and ballasts uses 6 watts. The same fixture uipped with the Optimiser System uses 116 watts. In the average office lighting application, the energy savings per fixture will be $12.60 per year (3000 ABHR, 7¢/KWH).

And because the Optimiser fits all standard 40-watt four-lamp fixtures, it's especially suited to retrofitting, in addition to its many applications in renovation and new construction projects.



Technically speaking.

The key to the Optimiser System's performance is the combination of improved electromagnetic circuitry and field proven electronic components in the ballast matched to a specially designed lamp. The heart of the system is a solid state switch in the ballast that cuts off power to the lamp's bi-modal cathodes once the lamp is on. The lamps continue to operate at full light output without cathode heater voltage. The result is a highly efficient fluorescent system that operates at 34% lower wattage than standard.

This also means the Optimiser ballast operates up to 30°C cooler than standard ballasts. Which results in extended ballast life and, depending upon the particular HVAC system, may lower air conditioning costs.

116 watts means reduced watts per sq. ft. with 97% light output.

TYPICAL INITIAL & ANNUAL OPERATING COSTS (NEW FIXTURES)			
LAMP BALLAST	4-STANDARD 2-STANDARD	4-F34 ENERGY SAVING 2-ENERGY SAVING	4-OPTIMISER LAMPS 2-OPTIMISER BALLASTS
Number of Fixtures	122	122	122
Maintained fc (10,000 Sq. Ft.)	70	67	68
Initial Cost (Labor & Material)	$15,362	$15,684	$17,973
Annual Operating Cost 3000 Hr/Yr 7¢/KWH	$ 4,984	$ 4,069	$ 3,784
Watts/Sq. Ft.	2.15	1.67	1.42

It's obvious the Optimiser System is more sophisticated than the standard fluorescent system. In the matrix above Optimiser proves to be the most cost effective system. For your next lighting project compare Optimiser and you'll see how a lighting system that costs a little more initially can be a lot less expensive to operate in the long run.

If you'd like a complete package of information or just have some questions about the Optimiser System, call us toll free at 800-321-7170. (In Ohio, 800-362-2750.)

We bring good things to life.

GENERAL ELECTRIC

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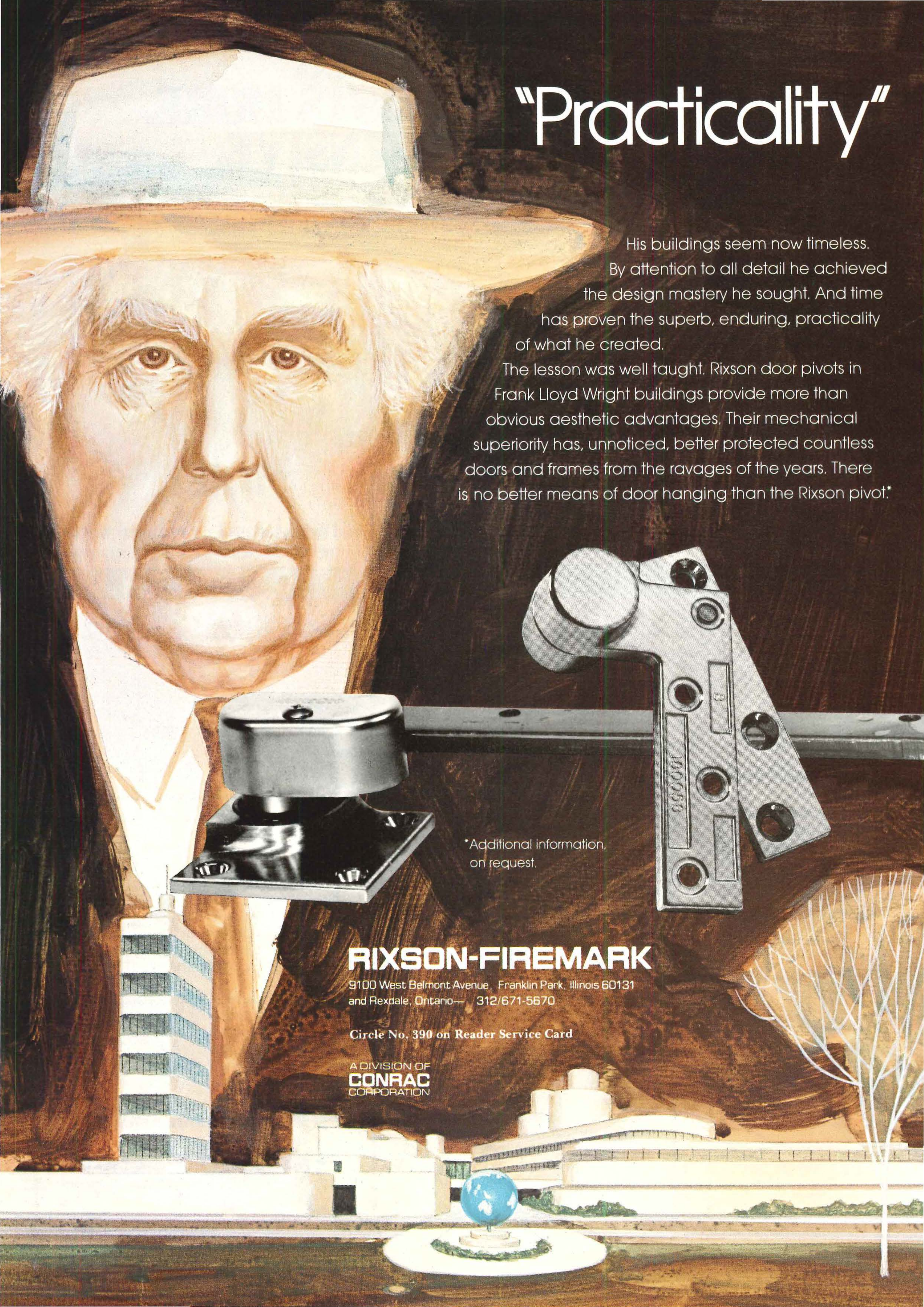
"Practicality"
His buildings seem now timeless. By attention to all detail he achieved the design mastery he sought. And time has proven the superb, enduring, practicality of what he created.
The lesson was well taught. Rixson door pivots in Frank Lloyd Wright buildings provide more than obvious aesthetic advantages. Their mechanical superiority has, unnoticed, better protected countless doors and frames from the ravages of the years. There is no better means of door hanging than the Rixson pivot.*
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ENERGY-EFFICIENT SYSTEMS HAVE ALWAYS COST LESS TO OPERATE. HERE'S ONE THAT COSTS LESS TO INSTALL.

pecifier Series: No. 2
'he GE Maxi-Miser II system.

'here's more ıan one way ɔ design an nergy-effi-ient lighting ystem. You an cut wattage vhile keeping the ame light level.

Or you can keep the same amount f watts, get more light, and use ewer lamps and ballasts.

Which is exactly the principle ehind the Maxi-Miser™ II lighting ystem from General Electric. It's omprised of Maxi-Miser II lamps ombined with Maxi-Miser II allasts. Together, they deliver nore light than any other 4-foot uorescent system commercially vailable.

And unlike any energy-efficient ystem you've dealt with, the Maxi-Miser II system costs less to nstall. Fewer lamps and ballasts re needed, so labor costs are lower.

TYPICAL INITIAL & ANNUAL OPERATING COSTS (NEW FIXTURES)			
FIXTURE TYPE LAMP BALLAST	4 LAMP-LENSED STANDARD STANDARD	4 LAMP-LENSED MAXI-MISER II MAXI-MISER II	3 LAMP-OPEN (TANDEM WIRED) MAXI-MISER II MAXI-MISER II
lo. of Fixtures	122	97	122
Iaintained FC (10,000 Sq. Ft.)	70	70	71
ıitial Cost* Labor & Material	$15,362	$13,440	$15,179
ınnual Operating Cost, 3,000 Hrs./Yr. 7¢/KWH	$ 4,984	$ 4,035	$ 3,813
Vatts/Sq. Ft.	2.15	1.64	1.54

ˈased on GE suggested user prices and assumed labor costs.

Iore light from a 40-watt lamp.

There are sound reasons for ıis extra light output. First, a Iaxi-Miser II lamp has a special lectrically-insulated shield of high urity steel around each cathode. 'his shield catches end-blackening ıaterial, which improves lumen ıaintenance substantially.

Second, GE combines neon in the ll gas along with a coating of high erformance phosphors to give ıese lamps a 3450 lumens rating. The highest in the industry for a 40-watt fluorescent lamp.

The Maxi-Miser II system in the four-lamp troffer.

With this system, you can reduce the number of 2 x 4, 4-foot fixtures needed by 20%. This cuts energy costs while maintaining the same light levels as a standard lamp and ballast system.

The Maxi-Miser II system in the three-lamp troffer.

If energy codes are requiring you to limit watts per square foot, you can do so without reducing light levels. Just specify the Maxi-Miser II system in a three-lamp fixture. The maintained light output will be equal to a standard four-lamp troffer. But wattage will be cut by 28%. In addition, where air-handling fixtures are the choice, Maxi-Miser II lamps can perform even better.

The Maxi-Miser II system: maximum design flexibility.

The Maxi-Miser II system gives you the quality of light you demand along with the energy efficiency you need.

It's ideal for new construction and major renovation. Because it provides the design flexibility that's required to meet different criteria.

It gives you flexibility with choice of fixture. Because General Electric works with fixture manufacturers to ensure our lamps are compatible with virtually any fixture you specify.

TYPICAL TROFFER PERFORMANCE* PERFORMANCE MATRIX			
FIXTURE TYPE LAMP BALLAST	4-LAMP-LENSED STANDARD STANDARD	4 LAMP-LENSED MAXI-MISER II MAXI-MISER II	3 LAMP OPEN (TANDEM WIRED) MAXI-MISER II MAXI-MISER II
Initial Lamp Lumens	3150	3450	3450
Lamp Life (Hrs)	20,000	15,000	15,000
Ballast Factor/ Thermal Factor	.95	1.00	.99
C.U.	.75	.75	.81
LLD (Mean)	.876	.91	.91
LDD (Typical Office)	.732	.768	.768
Watts/Fixture	176	169	127

*Based on GE Tests

Maxi-Miser lamps, in either warm or cool colors, are readily available in all parts of the country.

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C-204B

Typical Levolor Inclined Blind Installation

nterior technics:
nergy-conserving lighting

Light loads

ımes R. Benya

'he need for energy onservation continues to enerate new developments ı lighting design, echnology, and products.

In the design of virtually all buildings since the mid-1970s, the conservation and management of all forms of energy have been top priorities. Energy has had an impact on the exterior envelope, HVAC systems, and most of the equipment used within. But no system of the building has been more obviously affected than its lighting system.

Daylight and electric lighting systems are the only practical modern techniques for providing light. Prior to the "energy crisis" of 1973, building designs having large-scale and effective daylighting systems were few; typical designs involved large areas within a building envelope. Electric lighting systems providing task lighting levels in every corner of the space were the state of the art. At that time, lighting consumed about 5 percent of the nation's energy and about 20 percent of the generated electricity. When the energy crisis began, people were encouraged to "turn off the lights" and thus save energy.

Despite numerous energy regulations, countless studies, many federal and state specifications, and various energy-saving guides, energy conservation and management involving lighting have been profoundly affected by one thing: the rise of the cost of energy. In the last decade, the cost of electricity has risen about 400 percent. Today, the most energy-efficient buildings will cost about $0.50 per square foot annually to light; conventional designs of the 1960s, in comparison, would easily demand three times that amount.

The energy equation

In general, lighting calculations lend themselves well to a fundamental energy equation (Energy = Power × Time), since most electrical devices are rated in watts (power) and the unit of electrical energy is kilowatt-hours. There are no subtle factors, such as thermal mass, to make the calculations more difficult. Thus, the architect or engineer can, through design: *minimize the power* of lighting systems and *minimize the time* in which lighting systems are used.

Most energy codes (such as ASHRAE standards 90-75 and 90-80) address only the connected power of the lighting system, providing no practical formula to address length of use. However, by demand of building owners and users, the industry has responded with equipment and systems that address both parts of the equation. By utilizing the proper combination, the architect can dramatically decrease the cost of lighting energy.

Daylighting design

Introducing daylighting as a major source of interior lighting can save large amounts of energy. Daylight has an excellent color spectrum and well-understood psychological benefits in interior spaces. Compared to electric light sources in terms of the relative impact on HVAC systems, daylight is equivalent to having electric sources operating at 140 lumens per watt without dirt or lumen depreciation factors.

To use daylight effectively in energy-conscious design, however, the designer faces a considerably more difficult problem. First, the light must be directed to the work area. Second, it must be of an appropriate level (illuminance) for the work tasks. And finally, there should be means to control and compensate for its many variations, including day/night cycle, daily weather variations, and seasonal differences in solar angle.

Aside from classic design standards, architects have used scale models and generalized calculation techniques in order to predict the effects of daylight on designs. Recent developments in illuminating engineering have enabled computer programs to be written that provide detailed point calculations of daylighting effects on an interior space. Using such tools during conceptual design, the architect could determine whether the design effectively lights the task, or simply floods a small part of the room with too much light. In more complicated designs, illuminating engineers may consult and help in the development of reflectors or diffusers. (Kahn's Kimbell Museum, P/A, Nov. 1972, p. 25, is an example of such interaction; his consultants, Richard Kelly and Isaac Goodbar, used mathematics to confirm and then engineer Kahn's original idea.)

It is necessary to minimize stray daylight, just as one minimizes the use of electric lights when not needed. Adding energy to a space in the form of light represents a heat load. Even if the space is shielded from direct solar radiation, the amount of this energy can be significant, if not controlled. A well-designed daylighting system will impose 50 to 75 per-

ımes R. Benya *is an associate ıd Chief Electrical Engineer r Health Facilities at Smith, 'inchman & Grylls Associates, ıc., Architects, Engineers, and 'lanners, Detroit, Mich. He also rves as Lecturer in Lighting esign at the University of 'ichigan, School of Art.*

1a) Floor plan of test model: A nominal 15' x 15' office with south-facing window is used for demonstrating electric lighting and daylighting techniques later.

1b) Section of test model: This shows specifically an overhang whose impact on daylighting is analyzed in Fig. 2.

2a) This computer simulation of daylight entering the office without an exterior overhang shows that natural light penetrates only a few feet into the room; that light levels near the windows are very high, averaging over 1100 footcandles; and that the contrast or illuminance ratio is, at its worst, 80:1. To match that lighting level with artificial illumination would require 10 watts per square foot.

2b) The second computer simulation is of daylight entering the office with the overhang shown in 1b. The light levels still exceed minimum requirements, averaging 160 footcandles. But the light penetrates further into the room; the illumination is more widely and evenly dispersed; and the illuminance ratio falls, at its worst, to 5:1. The electric light equivalent also falls to 1.43 watts per square foot.

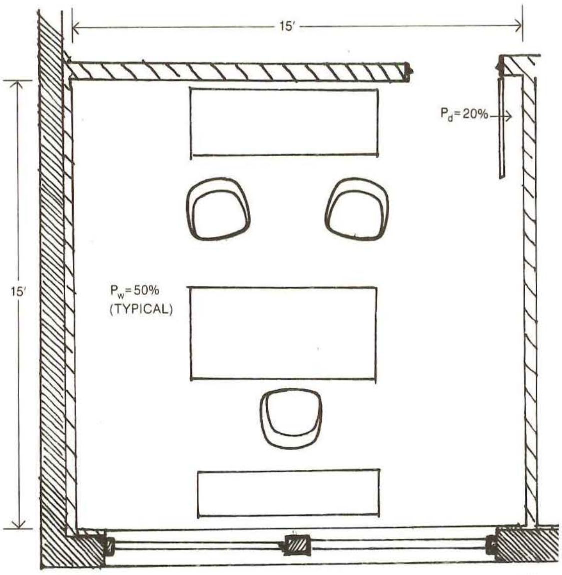


FIGURE 1a

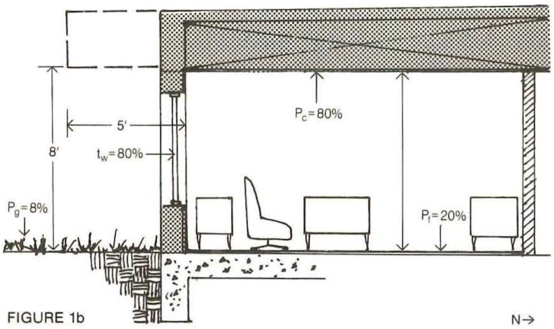


FIGURE 1b

cent of the cooling load imposed by an electric light system providing the same lighting level. More often, the cooling load is significantly higher, because the daylight is not controlled properly.

The computer modeling technique allows the designer to vary all the components of his system, including glass, orientation, angles of fenestration, and overhangs or shielding mechanisms, and then to study each for the appropriate seasonal and climatic variations. In Fig. 2a, the illumination of the simple office (Figs. la and lb) caused by daylighting without an exterior overhang is shown. By adding an overhang, the light distribution is made much more even, yet the levels on the desk are still quite high.

Similar studies can be undertaken of the effects of physical control of daylight. By varying the transmittance of the glazing, the computer program can demonstrate the effect of blinds, draperies, or other treatments. Daylighting systems that can vary transmittance through the use of mechanical controls are likely to have a broader range of conditions under which supplementary light is not required.

When electric light is required to supplement daylight, the control of electric light is introduced as another element of the system. Even if the electric light source is extremely efficient, it should not be allowed to be energized unless needed. The problem of maintaining a minimal light level is best handled by an "equi-illumination" system. Equi-illumination systems respond to daylight by

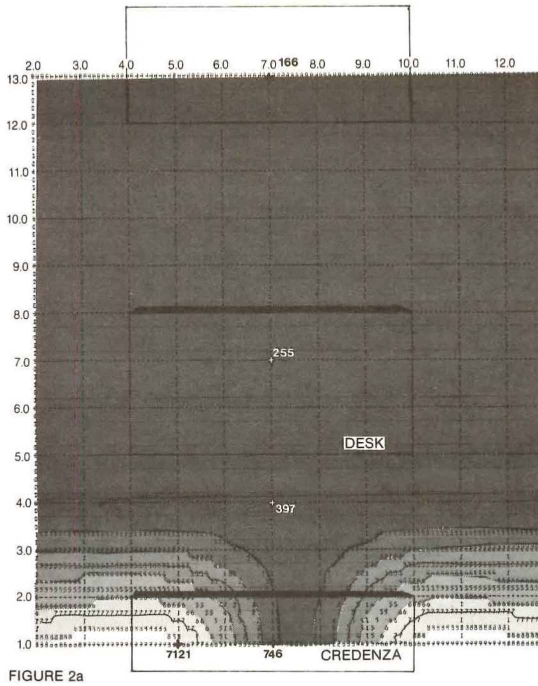


FIGURE 2a

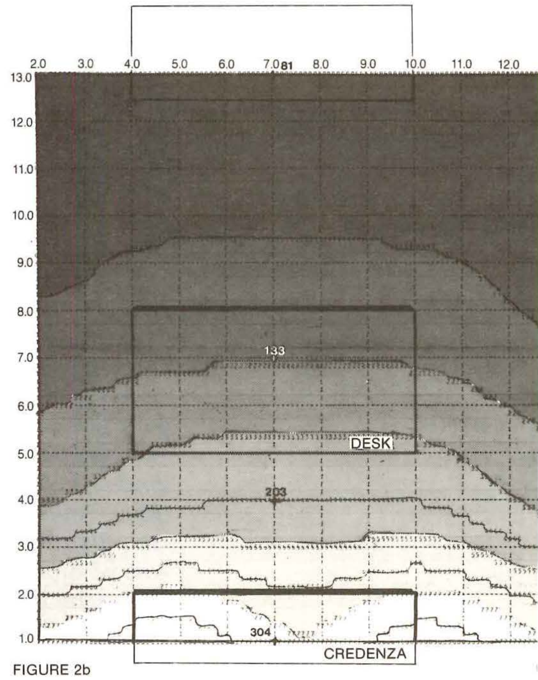


FIGURE 2b

dimming the output of supplemental electr lights. Depending upon the many conditio of location and orientation of space, local c mate, and normal operation schedule, equ illumination systems could reduce energ consumption in otherwise simply switche rooms by as much as 60 to 70 percent.

Appropriate lighting levels

The most often criticized lighting desig practices of the 1960s and early 1970s we overlighting ("more light, better sight") a general lighting. Overlighting was caus principally by the availability of cheap energ It encouraged architects and engineers to d sign lighting for the most difficult expect task rather than tailoring the light levels the actual tasks. High light levels, typica 100 footcandles or more, became standard the building industry.

General lighting was made prevalent by t availability of cheap energy and the lack o fast, accurate means for calculating lighti levels at individual task locations. Lighti ystems were in turn manufactured to give evenly distributed lighting when spaced at recommended intervals. The zonal cavity echnique of calculations, once used by all engineers and architects for determining light evels, was based on the assumption of even, uniform lighting.

The problems of overlighting and general ighting were always known but generally ignored because of cheap energy. With the energy crisis came a shift toward the modern practice of task lighting. It involves four major elements:

1 Determination of the appropriate lighting level for the task actually being performed, including consideration of the age of he viewer, the importance of speed and accuracy, and the visual difficulty of the paricular task compared with the average for his type. (See Appendix "A" of the IES Lighting Handbook, 6th Edition.)

2 Determination of appropriate lighting evels for areas around the task ("ambient") hat are generally lower than those required for the task.

3 Design of lighting systems that provide only the amount needed for the task and other areas.

4 Choosing lighting systems that lend hemselves to the reorientation or moving of asks within the space.

Task lighting—and not just furniture-ntegrated "task lights"—should be part of every design. Again, computer programs allow the computation of task light levels on a point-by-point basis. It is, in fact, possible to "aim" conventional troffers using this method see Fig. 3). Regardless of final luminaire election, task lighting can save 50 percent or more in connected lighting power compared with traditional general lighting systems.

High-efficacy lamps

The last decade has seen a tremendous emphasis on energy-saving devices and equipment, with electric lamp manufacturers a eader in the introduction of new products. At first, the lamp companies provided retrofit equipment, especially the 34/35-watt fluorescent tube. But designers expressed a need for amps that had better color rendering properties as well, and this spurred new development. Contemporary practice steers away from the use of incandescent lamps as much as possible for, as shown in Fig. 4, they have very low efficacy compared with virtually all other conventional sources. Low-voltage incandescent lamps have, however, eceived new emphasis and development. Offered in conventional PAR lamps and in new, -inch-diameter "MR-16" projector lamps, he low-voltage lamp's superior optical control will continue to offset its otherwise low fficacy for highlighting and for situations equiring sharp focus and precise beam conrol. Incandescent lamps also are still used where full-range dimming or instantaneous peration at all temperatures is required.

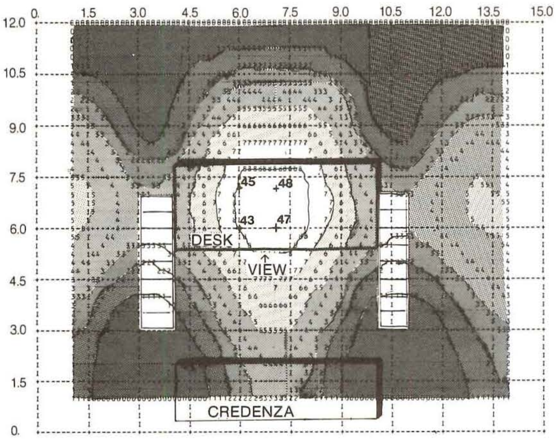


FIGURE 3 N↑

3 Task lighting—Test room with electric lights only (two-2 lamp F40CW parabolic troffers): Despite an average illumination level of 24 footcandles (maintained) and a connected power of 0.881 watts per square foot, nearly 50 footcandles ESI are produced in the task work area.

Fluorescent lamps are one of the largest areas of development and application. At first, the 34/35-watt retrofit lamps were introduced with average color rendering properties. With the introduction of new prime-color spectrum lamps and hybrid spectrum lamps, good color and high efficacy were made possible. Recognizing the designer's needs for various color temperatures as well, lamps have been introduced ranging from incandescent-simulating at 3000 K to daylight-simulating at over 7500 K. While most of these lamps have been designed for compatability with existing 3- and 4-foot fixtures and other common technologies, a few (most notably the T-8 lamp) will require all new luminaires and auxiliary equipment. One major area of new development has been in the fluorescent lamp replacements for incandescent lamps, especially for residential and light commercial use. The circular fluorescent replacement has been on the market for several years. New developments in miniature lamps will provide compact, long-life sources with minimal energy consumption.

High-intensity discharge (HID) lamps have also undergone significant development and greater use. High-pressure sodium lamps are the most efficacious of the "white" HID lamps, but their golden-white color caused considerable controversy wherever they were installed. Improvements in color, while maintaining the desirable efficacy and life characteristics of the lamp, were among the major technical achievements recently introduced. Metal halide lamps have gained the greatest acceptance of the HID lamps for interior applications, as their efficacy and lamp life have increased. The traditionally cool color of the lamps also has been warmed up; 3000 K metal halide lamps are now available. And specialty lamps, such as the compact source iodide (CSI) and the HMI lamp, designed for film and stadium lighting, have added options in excellent color rendition and efficient optical control. Roadway lighting has seen the introduction of the low-pressure sodium (LPS) lamp to the United States. Offering efficacy exceeding that of all other conventional sources, its energy-saving potential could not be overlooked despite its monochromatic yellow light.

Choosing the right source as an energy-conserving measure has been part of lighting design practice throughout history. The most significant difference now is that the selection of the source is a compromise between energy, color rendition, and operating considerations that include life, lumen depreciation rate, sensitivity to temperature and humidity, warm-up and restrike time, and ability to be dimmed to lower output levels. (It is especially important in systems supplementing daylight to be easily and effectively dimmable; it should be noted that HID lamps dim very poorly under the best of conditions, exhibiting very poor efficacy and undesirable color shift as their output is reduced from full value.)

High efficiency lighting systems
Design approaches have changed significantly in response to the demand for energy conservation. This has in turn caused the development of more efficient reflectors, louvers, lenses, and other components of the optic system. The net result is lighting equipment that is exceptionally efficient without sacrificing glare control. In recessed lighting systems, the best examples of this modern technology are the parabolic louvered troffer and the high-efficiency prismatic lens. Originally designed with deep louver "cells" for outstanding glare control and batwing distribution to enhance the ability of the system to render contrast (ESI), parabolic troffers now offer higher efficiency (over 70 percent) without substantial sacrifice of either glare control or distribution. And a number of new prismatic lenses are available which have the efficiency of the classic pattern 12 lens, but with better optical and glare-control features.

Indirect lighting systems, long recognized for their low glare and broad general distribution of light, have gained appeal as "ambient" lighting. The result has been the introduction of the HID lamp ambient light luminaire in many shapes and sizes, and the refinement and added efficiency of fluorescent indirect luminaires. Both approaches have also been used successfully for general lighting at task levels. With task lighting have come many luminaires using fluorescent lamps, designed to be attached to or integrated into office furniture. A few ingenious designs of luminaires provide, either from the furniture or from the ceiling, both task and ambient lighting.

Selecting the proper lighting system often involves the use of several different types of luminaires, each doing a specific job. This design approach takes advantage of the most efficient luminaires for the purpose, such as task lighting or ambient lighting. It also allows the designer to solve the problems of each independently, since the most difficult problem in task lighting—its ability to move around the space—differs substantially from that of ambient lighting—making the system efficient and controllable. Whether the same luminaires or separate systems are used for

	Age of technology[1]	Typical wattage[2]	Efficacy, lumens/watt[3] including auxiliaries		Energy saving features	Relative color rendering
Incandescent						
• conventional	pre-1970	3-2000	4-25		—	very good to excellent
• tungsten halogen	pre-1970	75-1500	18-21		—	excellent
• low-voltage	pre-1970 and current	25-300	15-20		superior optice allows lower unit wattages	very good to excellent
• energy-saving	1977-present	40-135	12-20		slightly lower unit wattage and/or better optical control	very good to excellent
			following are for 4 ft, 4100°K[4] lamps with fair color	good color		
Fluorescent						
• conventional rapid start T-12	pre-1970	30-215	73	50	—	fair color is typical of "cool white" fluorescents which tend to "gray" earth tones & reds (CR1 less than 75)
• energy saving rapid start T-12	1977	25-185	73		lower unit wattage	
• hybrid/prime color technology T-12	1979	25-95		73	increased efficacy with good color	
• second generation energy saving T-12	1981	34/35	78		increased efficacy, slightly better color	good color is typical of "cool white deluxe" with acceptable color balance for most applications (CR1 greater than 75)
• T-8 technology	1982	32		80	increased efficacy with good color	
• T-12 filament turn-off technology	1982	28	85		increased efficacy	
• incandescent replacement T-26 and FO	1977-1980	25-44	40-48		lower unit wattage (retrofit market)	very good
• "PL" lamps	1982	7-13	50		low unit wattage, small size	very good
High intensity discharge						
• conventional mercury vapor (deluxe white)	pre-1970	40-1000	23-59		—	fair
• improved color mercury vapor (style tone*)	1970	40-1000	16-50		—	good; warm color (3000°K)
• conventional metal halide	1970	175-1500	72-102		high efficacy	good; cool color (3500-4500°K)
• super metal halide	1975	1000	117		higher efficacy	very good; warm color (3300°K)
• super metal halide warm color	1982	175-400	72-85		improved color	very good; warm color (3300°K)
• conventional high pressure	1975	50-1000	60-131		high efficacy	poor to fair (2000°K) sodium
• high pressure sodium retrofits for mercury	1977	150-360	72-89		lower unit wattage and higher efficacy	poor to fair (2000°K)
• color-improved high pressure sodium	1980	150-250	76-86		improved color	fair (2400°K)
• low-pressure sodium	1970	18-180	62-150		traditionally high efficacy	very poor (monochromatic yellow)

Notes
* Tradename of Westinghouse.
1 Approximate year of commercial availability, generally by more than one manufacturer.
2 Range typical to architectural applications. Others exist.
3 Range where shown generally from smallest wattages to largest wattages, respectively.
4 Not all features are available in other lengths or types such as Slimline or Instant Start. The emphasis is on the four foot lamp as it represents the largest market.

FIGURE 4: OUTLINE GUIDE TO ENERGY DEVELOPMENTS IN LAMPS

task and ambient light, the goal should be to minimize connected electrical load. Select the most efficient alternative, once assured that each has the same ability to meet design criteria (assuming that other pertinent issues such as aesthetics, cost, or function have been resolved).

Auxiliary equipment

Auxiliary equipment, which includes ballasts, sockets, wiring, and similar parts, superficially appears to have no bearing upon energy or efficiency. Ballasts were the first of these components recognized as candidates for energy-oriented development. Fluorescent lamp ballasts have traditionally consisted of magnetic (reactive) coils operating at the nominal power distribution frequency of 60 hertz. The internal losses in the ballast typically ran from about 10 percent (super premium or low-heat grade) to 15 percent (specification grade). Modern energy-saving ballasts for standard four-foot lamps (the most common and highly developed) are of three types:

- *Low-loss 60-cycle magnetic,* which are conventional ballasts designed specifically for operation with 34/35-watt lamps;
- *Low-loss 60-cycle magnetic with filament switch,* designed specifically for operation with special 28-watt lamps, the cathode-heating filaments of which are de-energized when not needed;
- *Electronic high-frequency,* capable of operating with most 40- and 34/35-watt lamps, which actually cause lamps to produce 10–15 percent more light per watt.

The choice of ballast generally involves a concern for first costs, particularly with the electronic ballast, whose current market price is significantly higher than the magnetic types. The other two magnetic systems, however, are limited to standard rapid-start technology, and tend to operate lamps on the edge of thermal stability, supporting the prediction that electronic ballasts will become competitive in the foreseeable future. In any case, energy-saving ballasts can reduce overall energy consumption by 10 to 15 percent compared with standard ballasting. HID ballasts have not yet felt the emphasis on energy-conserving concepts. This is partly because of the delicate balance between ballast and lamp, especially for the HPS lamp, and also because the ballasts have always been relatively efficient (7–15 percent) and are not easily improved. Electronics will enter this realm at a much slower pace, largely due to concerns over the reliability of power semiconductors compared to magnetic coils.

Among auxiliary components, the most widely sold as a pure energy saver is the rectifier disc. Placed in a standard medium-base socket for an incandescent lamp, the disc converts the power delivered to the lamp, thereby delivering slightly over 50 percent of the power ordinarily consumed by the lamp. Although it reduces lamp output by 75 percent, reduces efficacy by 50 percent, and changes the color rendering properties of the lamp, the disc provides the side benefit of dramatically extending lamp life. Used in areas oversupplied with incandescent light, it may be a wise investment, but such devices are for retrofit applications, not new designs.

Controls

Of the ways in which the revolution in electronics has served the construction industry, lighting control is one of the most significant. In some instances, electronics have updated traditional concepts, such as the multiprogram time clock. But most of the newer products have no precedent. The designer is faced initially with a number of control possibilities (see Fig. 5). Beginning with manual controls, such as ordinary light switches, these include, progressively, automatic time control systems, automatic light (photocell) control systems, proximity detection systems, and equi-illumination (automatic dimming) systems. The most sophisticated concepts use building management systems to include all of the systems described above, plus the overall building electrical loads for demand limiting and co-generation applications. The selection of the control type depends on the maximum energy-saving potential, based on how the building or space is used, compared with the cost of energy.

Another major design issue is the definition of control zones. For facilities with rigorous work schedules and fully manned work areas, an on-off switch or simple time clock could effectively control millions of square feet. An infrequently used space, on the other hand, would benefit from an individual switch or occupancy sensor. This issue becomes important when considering open office plans and similar spaces with varying work schedules, unpredictable personal schedules, and ill-defined personal territory.

The third major issue for the designer involves techniques of wiring and system communication. Line-voltage control systems, such as conventional wall switches, work directly upon the wires providing power to the lighting load. This is also true of unit automatic control devices, such as simple time clocks and residential photocell switches. But at more complex levels of system operation, especially if the system is communicating to a central computer, the designer may select from low-voltage, low-voltage multiplex, or power-line signal (carrier current) systems. The selection of these options depends on the control functions and zoning of the system; the more expensive carrier-current system components require significantly lower labor costs when switching individual fixtures.

The fourth major issue confronting the designer involves the use of dimming, especially when not part of an equi-illumination system. Theatrical dimming technology, including digital dimmers, smart dimmers, automated presets, and foolproof controls, is being introduced into the expanding architectural dimming market, and offers potential energy savings. A ballroom system in a hotel, for example, can limit the connected power except during programmed periods to only those loads necessary for setup or cleaning.

Strategies for design

Given these six major areas in which energy can be conserved or managed—daylighting, task lighting, lamps, luminaires, auxiliaries, and controls (Fig. 6)—the designer needs a strategy for balancing each to gain the optimum benefit. In the strategy outlined below, the first four steps are taken prior to the schematic design of the building, permitting the development of basic architectural design involving daylighting and electric lighting concepts. These steps should not, however, prejudice the lighting design itself.

1 Determine the desired benefit or energy goals of the project. Very few projects will invest in energy-conserving measures without demonstration of a reasonable payback or return on the investment. Conversely, many projects will make an investment above a minimum first-cost budget dependent upon the return on that incremental investment. Because of the cost of energy, the goal is often measured in economic terms. Therefore, the architect or engineer needs to discover the payback or return on investment expected by the investor.

2 Qualify the project according to its potential for various methods of conservation. A project's siting, including climate, orientation, and relationship to nearby buildings, will heavily influence pursuit of daylight, for example, whereas a rigorous, industrial work schedule might suggest time-oriented control systems.

3 Establish design criteria for illumination levels, required visual comfort, color rendition, and general human functionality of the lighting system. This will narrow the design alternatives considerably. For instance, a requirement for excellent color rendition in a supermarket would eliminate most HID lamps, especially HPS. Or the need to relocate a certain task frequently within a large, otherwise non-task area might disqualify recessed troffers as both ambient and task-lighting systems.

4 Identify the suitability of auxiliary equipment, particularly for fluorescent systems. Aside from cost concerns, owners of existing facilities might wish to retain a certain technology, such as standard 40-watt rapid-start lamps, rather than incur the complications of stocking several different lamp and ballast types for maintenance purposes.

5 Consider the potential of daylighting as part of the architectural design of the project. The use of both illumination and mechanical consultants on complicated designs can optimize the daylighting effects without adding substantially to the cooling load. The daylighting design, in turn, presents various opportunities to the overall lighting design, particularly for electric lighting equipment.

The remaining steps in developing the strategy can then be pursued.

6 Assess each space for the impact of daylighting and determine the amount of energy left to be subject to further measures.

7 Propose practical and acceptable combinations of luminaires, lamps, and auxiliary equipment as complete lighting designs for each space. This will establish a maximum power upon selection of a scheme. Note that in the proposing of alternative designs, or in the selection of the scheme itself, it may be necessary to evaluate the cost benefit of reduced power equipment versus added investment.

8 Propose practical and acceptable control schemes, including types of control equipment and system zoning. This is the last major step, because each scheme will be compared on the basis of its energy savings versus its investment over and above the minimum code requirements. It stands to reason that, while lighting is obviously required for a space, sophisticated controls (such as occupancy sensors) are optional for the functional and effective use of the space, and any proposal should justify such an investment.

Earlier steps may be taken over again if warranted by the conclusions of a later step. In fact, this outline, like the strategy it suggests, must remain flexible if it is to benefit the wide variety of projects to which the conservation and management of energy through lighting design now apply. □

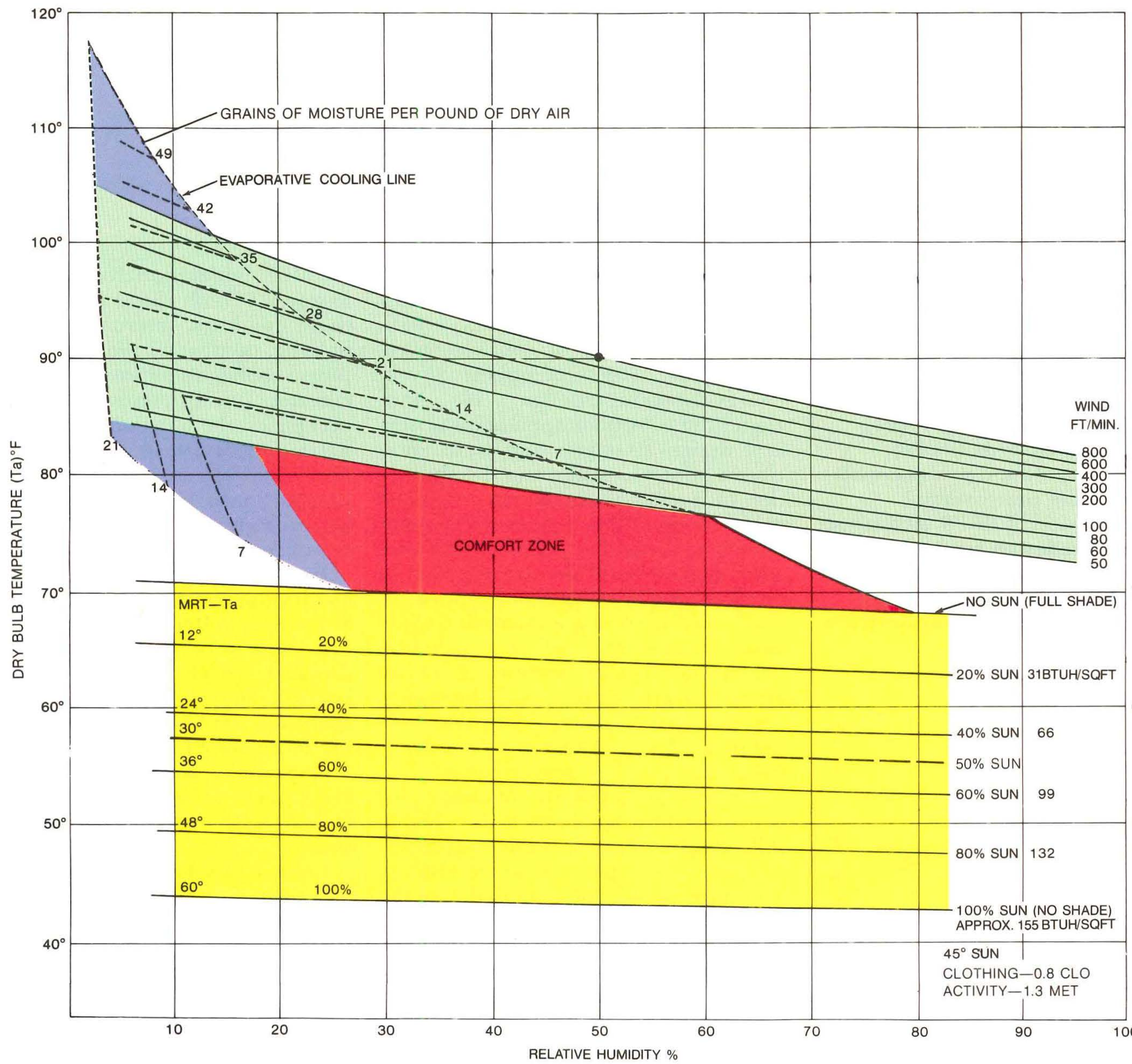
	Elements Managed Time	Elements Managed Power	How does it save energy	Effect upon new design compared to 1970
Daylighting	●	●	minimize use of electric lights and associated HVAC	depending upon architecture, could save 25 to 75% of energy (time and/or power)
Task lighting		●	minimize lighting levels	typically, reduce power 50%
Using efficient lamps		●	maximize lamp efficacy (lumens/watt)	increase from 50 to 100 lumens watt (lamp only) average of all types on project
Using efficient luminaires		●	maximize luminaire efficiency (CU)	increase from 60 to 70% averag of all types on project
Using efficient auxiliaries		●	maximize lamp & auxiliary efficacy (lumens/watt)	increase from 40 to 90 lumens/ watt average of all types
Using controls	●	●	a. minimize "on" time to "task" time	decrease on time by 10-25%
			b. minimize lighting levels dramatically	decrease average power 10%
			c. respond to daylighting variations	(see daylighting)

FIGURE 6: TECHNIQUES OF LIGHTING ENERGY CONSERVATION

	Management of: Time	Management of: Power	Applicable to: Residential	Commercial Small	Commercial Large	Industri
Manual Control						
switches	●		●	●	●	●
dimmers	●	●	●	●	●	
switch-operated contactor or relay	●		●	●	●	●
ballroom (assignment) with preset levels	●	●			●	
Automatic Control						
timers and time clocks	●		●	●	●	●
photoelectric control (switch)	●		●	●	●	●
proximity and occupancy sensing	●			●	●	
demand limiting		●			●	●
equi-illumination (dimming with photocell feedback)	●	●		●	●	●

FIGURE 5: OUTLINE GUIDE TO CONTROL SYSTEMS

3ioclimatic chart



;ioclimatic chart
'he bioclimatic chart originally de-eloped by Victor and Aladar Olgyay in ıe 1950s (P/A, Oct. 1982, p. 114) has een revised as a result of additional re-search and is keyed to the new ASHRAE omfort standards.

Iow to use the chart
Vith average daily temperature and ıumidity amplitudes for various ıonths, select the appropriate design lement—Solar radiation, Surface radia-ion, Air velocity, or Evaporative ooling—and determine the amounts ıeeded to provide thermal comfort.
:vaporative cooling (blue): High tem-eratures and low relative humidities an be made comfortable by evaporative ooling, effective only in the shaded rea to the left of the "evaporative cool-ıg" line. For example, 91 F and 20 per-ent relative humidity would be restored ɔ the upper boundary of the comfort zone by adding, on the average, 21 grains of water per pound of dry air to the environment.
Air velocity (green): Temperatures in the upper 80s can be comfortable if the relative humidity is not high and there is a breeze. The air velocity lines describe the upper limits of comfort at various humidities and air velocities. For example, 90 F and 50 percent relative humidity is thermally comfortable with an air velocity of 800 feet per minute, about 9 mph.
Solar radiation (yellow): Temperatures as low as the mid-40s are comfortable under the full effects of the sun. Above that temperature, provide shading as required to avoid overheating. For example, 56 F and 60 percent relative humidity is comfortable with approximately 50 percent of an average sun at 45° elevation.
Surface radiation (yellow): Surfaces that are warmer than the surrounding air temperature can have a warming effect similar to the sun. This difference between the Mean Radiant Temperature and air temperature is shown on the chart as MRT-Ta. For example, 56 F and 60 percent relative humdity is comfortable with radiation from nearby surfaces whose mean radiant temperature is 30.5 F above the 56 F air temperature.

Acknowledgments
Research was conducted by Edward Arens, UC Berkeley; Lutfi Zeren, Technical University of Istanbul; Richard Gonzalez and Larry Berglund, J.B. Pierce Foundation Laboratory; and Preston McNall, National Bureau of Standards. The work was supported by the Department of Energy. We would like to thank the National Bureau of Standards for permission to reprint the chart.

168 proof?

Over the last year, this series of energy-conscious design articles has taken a fresh look at the largest building research project ever undertaken: the energy redesign of 168 building designs in 13 building types as part of DOE's Building Energy Performance Standards (BEPS). Although many design professionals are aware of the controversial regulatory aspects of BEPS, an analysis of the actual redesign strategies forming the technical basis of the design energy budgets has never appeared in print prior to this series in P/A.

This effort has been funded by Battelle/ Pacific Northwest Laboratories under a program sponsored by the Buildings Division of the U.S. Department of Energy.

This article series forms the basis for a comprehensive Battelle report on the redesign experiment entitled "Energy Conscious Design: Redesign Strategy Summaries from the BEPS Phase II Research," which will soon be available for sale by the National Technical Information Service (NTIS), 5225 Port Royal Road, Springfield, Va. 22151.

After reflecting on the six technical articles in this series discussing the redesign of 12 different building types, we have come to a number of conclusions regarding the targets of opportunity in energy-conscious design. We have found the consistent application of several design strategies and have identified noticeable patterns in the application of design strategies that cut across many of the building types where similar energy concerns are shared. These strategy patterns in the redesigns led to a regrouping of the building types originally used in the experiment into three basic categories: offices, including clinics and schools because of similar energy relationships; retail buildings, which we have further subdivided; and buildings that contain a mix of residential spaces as well as service areas.

Because of similarities in usage patterns and functional space mix, highly individualistic buildings can be grouped into generic types. From an energy standpoint, a working knowledge of the energy impacts of usage patterns and space use is invaluable to designers, especially in the preliminary design phase when initial decisions can have enormous impact on subsequent energy efficiency. A regular daytime occupancy profile, for example, raises a different set of concerns from those found in buildings used predominantly at night, because internal and solar loads affect heating and cooling requirements in dramatically different ways. Also, space use in the building determines the predominant environmental conditions to be maintained, as well as artificial lighting levels and certain envelope criteria, such as window area.

Awareness of the relative impact of these factors is essential to the selection of appropriate design strategies for a given building. The use of design analysis tools to predict results can fine-tune the design and provide a higher level of confidence in their selection.

Offices

Small and large offices, clinics, and elementary and secondary schools all share a predominant daytime occupancy pattern. The diurnal heating and cooling problem, which was evident in the office building analysis, is also founc to apply to both clinics and schools. I these buildings, internal loads due t lighting, occupants, and equipment im pose a cooling requirement even in col climates. During periods of little or n occupancy, the situation is reversed, an heating loads due to nighttime conduc tion losses are of concern. Dependin on the climate, most of the annual heat ing consumption can occur during un occupied periods in these buildings.

In response, strategies that reduc conduction losses were frequently used Surface-to-volume ratios shrank, insula tion levels were improved, and noncon ditioned spaces were often placed a buffer zones between a conditione space and the building's exterior. Build ing reorientation, primarily in the sma offices, clinics, and schools, allowed th redesigners to take advantage of con trolled solar exposure on a season basis.

Control of solar gain was found to b especially important in these building A main redesign trend was the no uniform treatment of the building e velope depending on solar exposur Window area reduction, selecti reorientation of glazing, and use of bot internal and external shading device were the major solar control strategie employed. These strategies respond t the dynamic interaction of intern loads and solar gains that change by e posure over the course of a day.

Artificial lighting is a major end use i offices, clinics, and schools, and muc emphasis was placed on the reduction c artificial lighting and use of efficier luminaires. Lighting reduction lowe internal heat gains from lightin fixtures. Daylighting strategies we emphasized in offices and schools, muc more so than in other building type Thus many of the redesigned buildin forms were markedly different fro their original configurations.

HVAC equipment selection and co trol strategies were quite similar for th large and small offices and the clinic Redesigners of these building types co sistently chose variable air volum

VAV) systems over constant volume ystems in the larger buildings, and elected heat pump systems in the maller ones. School HVAC systems ended to rely more on control modfications than on equipment replacenent. Control flexibility is key to hanlling the intermittent usage patterns ind variable loads resulting from the nultiple use characteristics in many ducational spaces. With the combinaion of all redesign strategies, the ofices, schools, and clinics achieved some of the highest energy reductions in the experiment: 40–50 percent.

Retail stores

Retail buildings were originally classified as stores and shopping centers. To examine the retail redesign strategies in nore detail in these articles, however, hese buildings were reclassified as regional, neighborhood and strip shopping centers, and department stores.

The merchandising orientation of retail buildings naturally places design emphasis more on the building's interior systems than its façade. In contrast o buildings in the office category, retail facilities are less concerned with the dynamic solar load conditions, since hey typically have minimal window areas. Instead, high and uniform internal loads due to lighting and occupants mpose almost "steady state" cooling oads on the building at given weather onditions. Therefore, the redesign eams retained the original constant volume HVAC systems, but also applied nany control strategies to minimize pace conditioning energy. Economizrs, exhaust air heat recovery, and ime-of-day HVAC controls were paricularly effective.

Artificial lighting energy, which is often about 35 percent of the total annual energy usage, was a natural focus of attention in the store redesigns. Major lighting trends included the reduction of installed lighting capacity nd switching from incandescent to fluorescent fixtures. Daylighting appliations were mostly restricted to public irculation areas in regional shopping enters where walkways can comprise as nuch as one-third of the artificially ghted area.

Site, form, and orientation strategies nay have had little apparent impact on nergy reductions, except perhaps in trip shopping centers. Retail facilities re often subject to rigid site constraints. Roof area is often significant in this uilding type, and reflective roof treatnents and added roof insulation have he potential to be effective.

Residential occupancies

The occurrence of significant redesign rends common to buildings that share esidential occupancies has led us to roup together high- and low-rise multifamily buildings, nursing homes, hotels and motels, and hospitals.

While these buildings are quite dissimilar in many ways, they all share the common attribute of sleeping rooms attached to some type of service area. The continuum of functional space mixes can become increasingly complex from an energy standpoint as service areas comprise larger portions of the building program.

Guest rooms, patient rooms, and dwelling units have similar usage profiles and, to some extent, similar physical characteristics. They are generally occupied at night when outside temperatures can be at their lowest. Temperature setpoints are generally high, which sets the stage for high conduction losses over an extended period of time. Vision glass in these spaces often contributes to nighttime conduction losses as well as solar gains. When uncontrolled, these gains impose substantial daytime cooling loads on the space and its systems. This same glazing, however, can also be properly oriented and shaded for beneficial solar gains to offset heating losses if mass storage is provided.

Design approaches directed toward these energy concerns were applied to sleeping rooms in all these disparate building types. Wall and roof insulation was increased, glazing areas were reduced, building forms were made more compact, often with selective reorientation of south-facing glass. However, the requirements for environmental conditions in hospital patient rooms and for those in nursing homes may limit the use of passive solar strategies more so than in multifamily dwelling units and in motel and hotel guest rooms.

The difference in energy complexity among buildings that include sleeping areas is most evident in the mix of service areas to which these spaces are attached. In multifamily buildings, for example, these service areas or common spaces may be predominantly circulation areas with few internal loads. In other cases, service areas can range from large commercial kitchens in hotels to ancillary and support service areas in hospitals in which strict environmental conditions must be maintained. Although the exact nature of the space and its usage may determine (and even restrict) the design strategies applicable to it, service areas all share the potential for centralized control of energy use.

In the common spaces of multifamily buildings, centralized control was incorporated into HVAC systems for both recreation areas and corridors. Lighting

Over the past five years, over $30 million has been spent on research initiated to produce "baseline" data on the energy performance of new buildings and to determine maximum practical levels of potential annual energy conservation for the designs of new buildings. The effort was primarily to develop a data base that did not exist at the time to support the proposed Building Energy Performance Standards (BEPS). In these articles, the authors have attempted to strip away the regulatory issues that have obscured what the redesign teams accomplished, and to present it in a useful format. These articles have included:

A baseline for energy design (April 1982), which provides an introduction to the series, briefly describes the principal individual elements of the research, and presents overall results and observations.

Energy design of office buildings (June 1982), which focuses on the major redesign strategies used in small and large offices to address the characteristic concerns of diurnal heating and cooling and dynamic solar gains.

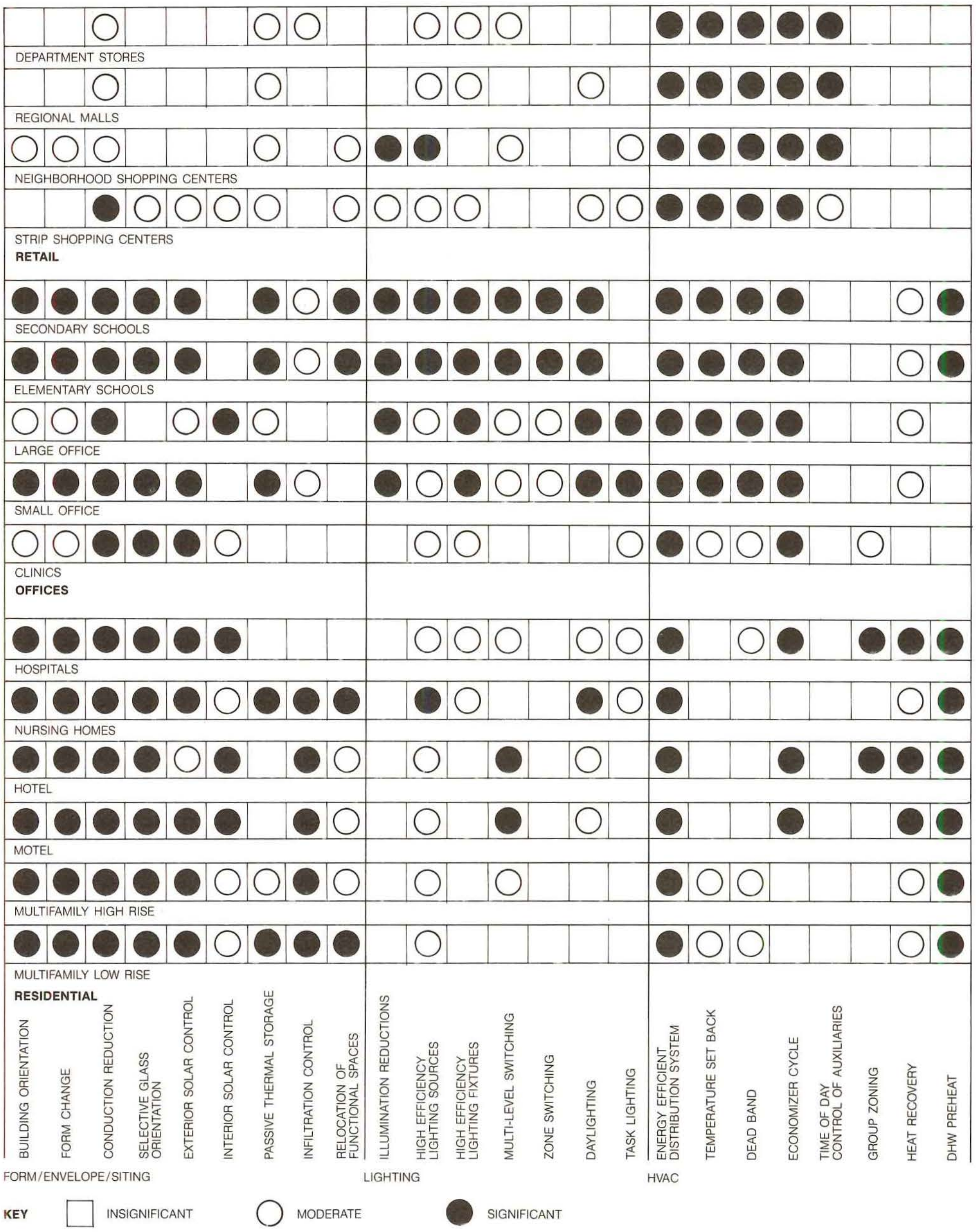
Energy for sales (August 1982), which emphasizes effective redesign strategies for retail buildings and discusses interior systems, such as lighting and HVAC, in characteristic internally loaded steady-state operation.

Dwelling with energy (October 1982), which concentrates on energy strategies for high- and low-rise multifamily dwellings and revealed that solar control and architectural design features play a surprisingly influential role in energy use.

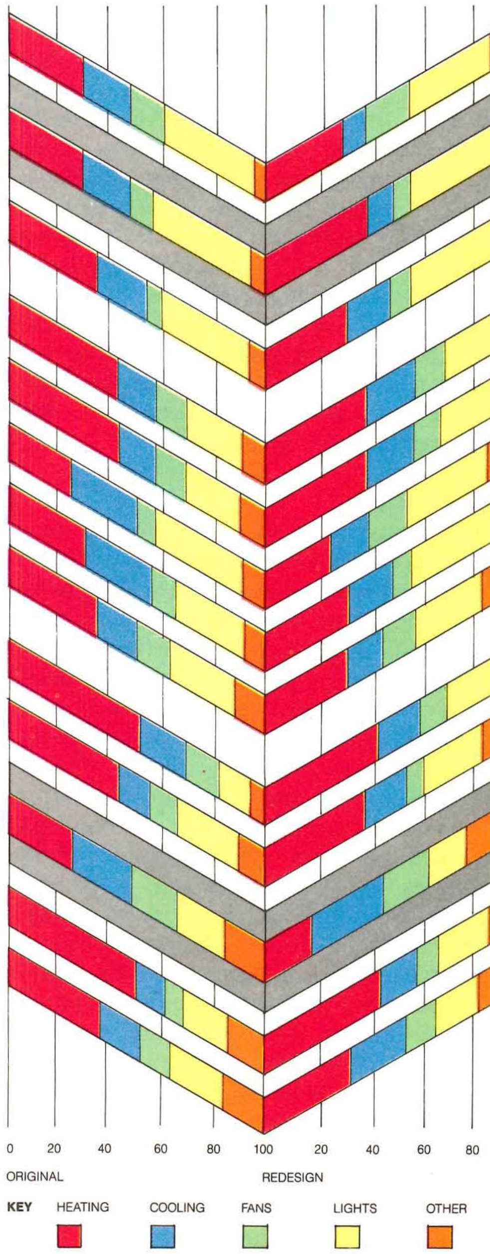
Bed, board, and Btu's (December 1982), which examines the diversity of nursing homes, motels and hotels as a continuum, with increasingly complex relationships between sleeping rooms and service areas. Relocation of spaces, outside air reductions, and shell tightening are a few of the strategies employed.

Energy to recover (February 1983), which highlighted HVAC and heat recovery strategies that were key in dramatically reducing hospital energy use without compromising health care criteria.

Energy: a class by itself (March 1983), which concludes that the energy importance of intermittent usage patterns inherent in elementary and secondary schools resulted in design decisions that enhanced the use of natural lighting while minimizing conductive gains and losses. Mechanical system controls for idle spaces were also important contributors to higher than average energy savings.



STRATEGY MATRIX: PHASE II REDESIGN TRENDS



ENERGY END USE PERCENTAGES (PERCENT OF TOTAL ANNUAL ENERG

systems for these spaces were put under the control of timeclocks. More elaborate strategies were used in hospitals to control strict environmental conditions by a strategic rezoning of hospital functional spaces to group together areas with similar environmental requirements on the same HVAC system.

Service areas are also often characterized by the presence of high internal loads caused by lights, equipment, and processes. Spaces such as these are candidates for the application of various heat recovery systems, such as exhaust air heat recovery. Also, a substantial portion of the cooling load in these spaces can be handled with economizer equipment. From a space usage standpoint, service areas, mechanical storage rooms, and corridors are often useful as buffer zones that can shield other conditioned spaces from conductive heat loss or solar gain when properly located.

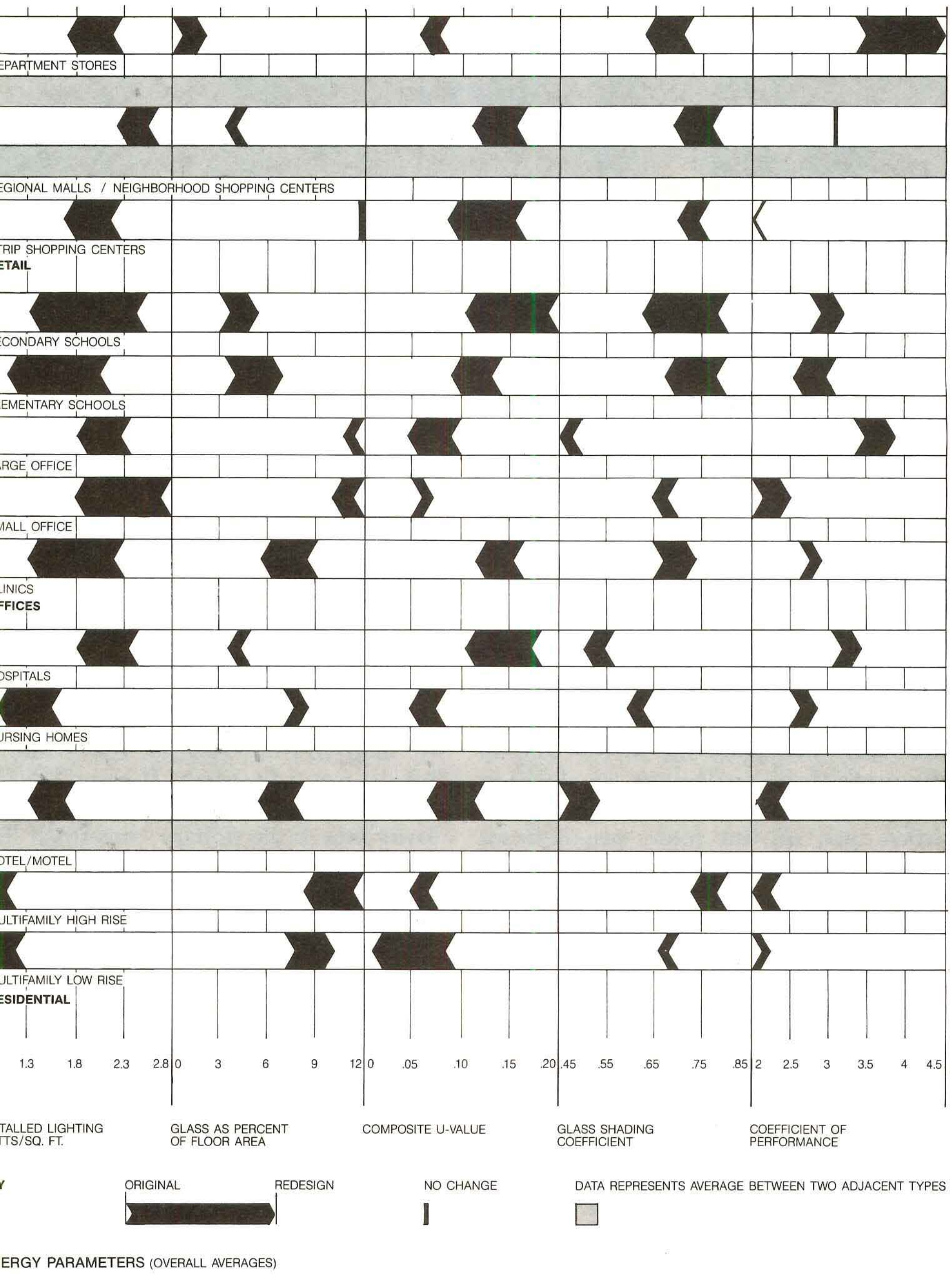
Research shortcomings

The redesign experiment was complex and fast-tracked, and subject to a number of geographic, energy, and economic analysis shortcomings. Building samples were limited to 37 different cities throughout the nation. In many instances, buildings from the Rocky Mountain states and the Sun Belt were underrepresented or not represented at all.

There also were flaws in the data. The energy analysis computer program, while sophisticated for its time, was unable to estimate the energy savings due to daylighting strategies or those attributable to the use of the temperature "deadband." There were also certain data handling errors, which resulted in unrealistic end use estimates for service water heating and appliance usage in certain building types. More important, energy usage and internal loads from "process" equipment were not included in the energy analysis because of certain policy decisions.

A significant shortcoming to the re design experiment was the lack o economic analysis to test the cost effec tiveness of the redesign strategies. Ecc nomic data for the redesigns are limite to the change in first cost of constructio in the redesign compared with that o the original building, a crude measur at best. The only detailed economi analysis performed was that of a life cycle cost study conducted on three of fice buildings one year after the majo research was completed.

We feel that these limitations do nc invalidate the basic findings of our re search and the conclusions on energ characteristics and strategy patterns. W do think, however, that a different set o design strategies could have emerged i the major objective of the original BEP research had been to reduce energ costs instead of energy consumptior



ad the pricing structure of energy pes been explicitly taken into account, is certain that more emphasis would ve been placed on the reduction of ectric demand, for example, and erhaps less emphasis on reducing fossil el consumption for space and service ater heating. Current building re- arch, with its emphasis on cost effec- eness, has taken this cue.

Another major obstacle in the series as that the data from which we worked ere not intended to evaluate the ergy effectiveness of particular design rategies. While the particular strate- es used were known, and their com- ned impact determined, the individual pact of each design element was often navailable. "Whole building" energy sults came from a combined package redesign strategies. Analysis of in- emental effects often involved using e redesigners' estimates, or even our n. The broad patterns for design op- ns were evident, however, even if in- vidual contributions could not be gregated.

The results

The principal product of the original BEPS research, from a design standpoint, was the development of design energy targets in a consistent and methodical manner. Ranges of energy use for 13 commercial building types in 78 geographic locations are now available for use by design professionals. Other DOE studies on contemporary energy-efficient building designs have shown that these targets are both reasonable and achievable.

The research for this series has looked beyond these abstract energy numbers to identify an additional set of products: the actual architectural and mechanical design strategies responsible for the substantial energy savings achieved by the redesign teams. The patterns of using these strategies in the redesigns are useful generic design data that can be effectively used by designers, especially in the early stages of design. □

Opposite: The strategy matrix, end-use percentages, and overall averages for selected energy parameters highlight the trends found in the Phase II Redesign experiment. Only the energy end-use percentages and energy parameters are based on quantitative data. The strategy matrix reflects the authors' judgment and observation of recurrent trends.

The high incidence of HVAC strategies in the retail category stems from the fact that these buildings can be best characterized as opaque shells that are internal-load dominated. Accordingly, the redesigns concentrated on targets of opportunity such as economizer and deadband controls, exhaust air heat recovery, return air troffers, process cooling heat recovery, and low static pressure distribution systems.

The offices category, by contrast, is characterized by high vision glass requirements (giving rise to coincident heat/cool demands) and a pattern of use in which these buildings are internal-load dominated during the day and skin-load dominated at night. Consequently, in this category we find the whole range of conduction reduction strategies (form compaction, unconditioned buffer zones, U-value upgrading, etc.) in addition to a very active management of the shell with regard to interior and exterior shading, glass orientation, and daylighting. System strategies included high efficiency lamps and fixtures, illumination reductions, multilevel and zone switching, HVAC distribution system changes, deadband and economizer controls, temperature setbacks, and heat recovery from condensers and exhaust air.

Patterns in the residential group vary somewhat with the complexity and nature of the support services. This category is very often skin-load dominated with high vision glass requirements. Again, we found the recurrent use of conduction and solar control strategies in addition to the application of some passive strategies (mainly in nursing homes and multifamily low rise). Heat recovery in all forms was also popular, mainly because of the multiplicity of process heat sources and demands.

The energy end use percentages in the original designs show the targets of opportunity available to the redesign teams. After the redesign and subsequent energy reductions, new end percentages present a new set of priorities for achieving further reductions.

The changes in overall averages in energy parameters, from the original building values to the redesign, support the identification of strategy trends. The variation in the parametric changes reflects not only the difference in conservation potential among the building types, but the original level of energy awareness in the redesign teams.

Feedback

In January, the authors of this series presented a summary of their research results at a seminar held in conjunction with the 30th Annual P/A Awards. Following the presentation, a panel of P/A Award winners and energy experts, moderated by series editor Richard Rush, discussed the articles and related design topics. Comments were then solicited from award winners and guests in the audience. Highlights of the discussion are presented in the second part of this article. Readers of P/A are encouraged to continue this feedback process with letters and expressions of their own opinions of the value of this article or any in the series.

Rush: From your experience as the designer of specific buildings, what is the relevance of a broad generic study such as this to your practice?

Mack Scogin: I think that what happens to a lot of people like myself who are somewhat neophytes at dealing with technical issues like energy is that we began to look at these kinds of articles and say, "Oh, my God, here's something else I need to know something about, and I'd better start doing something about it." What we've discovered over the last couple of years in our projects is that a lot of these norms and the intuitive responses developed after reading or scanning these types of articles are not necessarily applicable to specific buildings. Therefore, I think care must be taken with these sorts of generic articles not to overlook the fact that people have very, very simplistic responses to them. Don't be embarrassed as an energy expert to admit that this is a very complex problem and present it that way.

Rush: Donn Logan, does your experience in designing the San Jose State Office Building correspond to the overall trends represented in the series and if not, how does it differ?

Donn Logan: The State Office Building in San Jose would fall into the large office building category. It has more than 50,000 square feet (it's about 130,000 square feet), and yes, it does support the trends in a general way. I think we did, at least our computer printout says that we will, a little bit better with the general numbers. We may be down to 26,000 to 28,000 Btu's per square foot. The strategy we used emphasized daylighting more than some of the sample buildings.

Rush: What are the relative merits of an architectural magazine publishing a series of individual buildings as opposed to a series of articles about various building types? Should there be more emphasis in the press on such research?

Joseph Fleischer: There are a lot of very good bits of general information contained within the articles that one can get lost in, and they're the kind of things that we all do know exist and rarely, if ever, I'm afraid, apply to the general building design. It has a lot to do with the priorities that certain offices establish and the way in which they approach their designs. The use of the generic building types is important in that it gives us all general directions. Far too many people in the offices and in the profession, particularly the decision makers, are not oriented to this type of article per se, but more oriented towards understanding specific buildings and the way in which the problems were solved within those buildings.

Rush: Harrison Fraker, what studies of a similar nature could the government fund that would have a similar value to the profession?

Harrison Fraker: I'm primarily a designer and a teacher, so I'm interested in the nature of the information in these articles that reveals to a designer why a building loses energy in the patterns that it does. I think the work that P/A has done in this area in bringing out the beginning understanding of such reasons is commendable. But I think we're a lot wiser now, and I think we can take the work quite a bit further.

Before 1978, we didn't even know how much energy each of these building types used, and this first step at least breaks the energy use down by end use so we know how much is used for heating, how much for lighting, how much for cooling and hot water. That information is a first step, and we can begin to understand what causes the changes in the redesigned building. I'm interested in taking that information and taking each of those end-use areas and showing why a building uses so much for cooling, why it uses so much for heating, and so on. When designers identify the major targets of opportunity, they can then address those aspects of the building or the whole system that will really make significant reductions in the use of energy.

Another step of the process is what happens when utility costs are added to these numbers. In many places the biasing structure of the utility sets the priority on design strategies much more than the building form and envelope an[d] shape, and much more than th[e] mechanical system. Here's an exampl[e]. In the energy consumption in hote[ls] and motels, the overall Btu consum[p]tion for hot water is relatively low. Th[e] manager of a hotel will tell you th[e] number one priority is domestic hot wa[ter]. The designer has to ask why. Th[e] reason is that all the hot water is used i[n] one hour and in most cases there is [a] huge demand upon the system. If a[ll] you analyze is the energy, you wouldn['t] think it was a problem. If you analyze the dollar consumption and broke [it] down into both dollars consumed f[or] energy and demand, you would see th[at] it is a number one priority.

Rush: We'll ask Ted Kurkowski of DO[E] to address this next question. Would [a] government grant to construct 60 buil[d]ings each costing a half million dolla[rs] yield more valuable information than [a] $30 million research project such a[s] BEPS?

Ted Kurkowski: My reaction to th[e] question is that a program that intend[s] ultimately to transfer useful informa[tion] to other people must spend an in[credible] amount of money documentin[g] what has been done. What would hav[e] happened if we had built real building[s] rather than the study is that we woul[d] have studied only a few buildings, i[n] great detail, and probably not learned a[s] much; we possibly would have ha[d] greater acceptance of the data. N[o] money is saved by not building build[ings].

Rush: Fred Dubin is in the audienc[e] and participated heavily in the redesig[n] program. Fred, do you have som[e] comments?

Fred Dubin: First of all, you can't desig[n] a building from any article that's eve[r] written. If you do, it's not the righ[t] building. I believe in using specif[ic] buildings in the socratic method o[f] pointing out principles and sensitivitie[s].

The redesign program had treme[n]dously beneficial effects, whether it wa[s] worth $30 million or not. It did provid[e] directions. It also established average[s] which is very, very dangerous. If w[e]

The panelists in the photograph from left to right are: Mack Scogin, Heery & Heery; Joseph L. Fleischer, James Stewart Polshek & Partners; Harrison Fraker, Harrison Fraker Architects; Richard Rush, American Institute of Architects; Donn Logan, ELS Design Group; Dr. Vladimir Bazjanac, University of California at Berkeley; Harry P. Misuriello, W.S. Fleming & Associates. Not pictured: Joseph J. Deringer, Gilford, Deringer & Company.

have one foot in the refrigerator and one foot on the stove, the "average" temperature is comfortable. There is a need to do a very specific study for each building and each building type on a specific micro location and micro climate. Perhaps, with the building guidelines that came out of this program, one has an idea of what can be accomplished and then specific goals can be established. There is a great deal more work needed to develop design tools, a design vocabulary, and a library of parts and components information so that architects or engineering designers will know the consequences of their decisions before they have a building.

Rush: John Cable was instrumental in the initiation of this article series while he was still with DOE. John, what are your thoughts?

John Cable: As much information as this series of articles seems to contain, it only scratches the surface. There are some other pieces of good information available if you choose to dig for them. One of the fellows who used to work with me has now been in private practice for a year. I asked for his impressions, having crossed over from research to design. He replied: "I forgot that architects were so overwhelmed with getting a contract, signing a job, administering the contract, working with the client, meeting structural requirements, working with the code officials, getting the building financed, and trying to solve the liability problems." Energy was only a minute piece if at all. I don't know what your future plans are, but I think a book that just has all these articles in it with the summary of what we've learned would be a great desktop piece right beside the usual graphic standards and the structural steel handbook.

Rush: Bob Shibley was involved in a similar study, an analysis of the Owens-Corning award winners. I would be curious to know if he agreed or disagreed with the general conclusions.

Robert Shibley: There weren't any startling surprises. What we did find in the OCF trend analysis was that in the early 1970s we were doing a few energy-conserving strategies very well, and they were being celebrated in award-winning buildings as innovative or ingenious strategies. As more and more strategies became available, the challenge to the award jury was to relate the strategies and the confluence of all the issues necessary to bring a good quality building out of the ground. As part of that, and I'm going back to Ted Kurkowski's observations, if you have a choice between studying it or building it, and building it and studying it, build it and study it. Only then can we truly understand the implications and the context of anything we have to deal with to build.

Rush: This is the second such DOE-sponsored research effort P/A has been involved in. The first was a two-year study based upon individual computer analysis of chosen buildings, led by Vladimir Bazjanac. Vladimir, what is the difference between the qualitative information one gets from the sophisticated energy analysis of existing single building design and the kind of information obtained from examining 168 buildings or 25 buildings of a specific building type altogether. What can the individual architect do with the two kinds of information?

Vladimir Bazjanac: The 168 buildings do not basically provide you with enough information to be directly useful in the design process. All they can tell you is what might be done, and they give you an idea in the negotiating stages of what energy consumption the building is going to have. Some very useful ranges were produced. I wouldn't try for the exact numbers, simply because of the inconsistencies of methodology over a period of time. What we did with individual buildings was to provide a measure of what is accomplished by varying the design parameters. It was narrowed straight down to a specific set of design decisions that were investigated.

From the BEPS article, one can tell the client what the range of savings might be and what is reasonable to expect. Nothing would be learned about the specific building. Now, if the building was in a climate somewhat like Chicago, say, our energy analysis of Helmut Jahn's building, might produce relevant material.

There were a couple of examples in the BEPS articles that sort of dealt with buildings as we did. They often could not tell you in detail how much those components contributed. But they illustrated how some of those savings might be achieved.

In last April's issue, you used a number of descriptive titles: This is who and where and what. If you use that kind of terminology, ours would be called this is how. The BEPS study could be called this is how much.

Also in attendance:
Bernard Babka, Hammond Beeby & Babka; Robert Beckley, Beckley/Myers; Richard Bozic, Architecture-Research-Construction, Inc.; Harvey Bryan, Assistant Professor, MIT, School of Architecture and Planning; Alan Chimacoff; William Conklin, Conklin & Rossant Architects; Fred Dubin, Dubin-Bloome Associates; Elizabeth Erickson, Shepley Bulfinch Richardson & Abbott; John Eberhard, Advisory Board on the Built Environment; W. Paul Farmer, Planning and Design Partnership; Sheldon Fox, Kohn Pedersen Fox & Associates; Geoffrey Freeman, Geoffrey Freeman Associates; Robert Geddes, Geddes, Brecher, Qualls & Cunningham; Susan Gill, ABRI Design Associates; Raymond Gindroz, UDA Architects; Alan Green, Educational Facilities Laboratories; Robert Gutman; Michael Keihn; Doug Kelbaugh, Kelbaugh & Lee; Jonathan King, Architectural Research Laboratory, The University of Michigan, Ann Arbor; William Lam; Theodore Liebman, Liebman Williams Ellis; Sang Lee, Kelbaugh & Lee; David Lewis, UDA Architects; S.I. Morris; Daniel Pang, Daniel Pang & Associates; Donald Prowler, Department of Architecture, University of Pennsylvania; Peter Ringenbach, Perry Dean Stahl Rogers; Walter Rosenfeld, The Architects Collaborative; James Rossant, Conklin & Rossant, Architects; Peter Samton, Gruzen & Partners; Frederic Schwartz, Venturi, Rauch & Scott Brown; Robert Shibley, SUNY, Department of Architecture; Richard Stein; Thomas Vonier, Thomas Vonier Associates, Inc.; Peter Waldman; Ralph Warburton; Lawrence P. Witzling, Planning and Design Partnership.

Contributors: *A number of individuals and organizations have contributed to the development of this article series. Principal researchers: Harry P. Misuriello, Principal, W.S. Fleming & Associates, Inc.; Joseph J. Deringer, President, and Santiago Moreno, Associate, Gilford, Deringer & Company.*

Researchers: *James Binkley, Chief, and Ted Kurkowski, Program Manager, Commercial Building Systems Analysis, Architectural and Engineering Systems Branch, DOE; John Stoops, Project Manager, Ray Reilly, Program Manager, and Stan Pansky, Project Architect, Battelle/Pacific Northwest Laboratories; John H. Cable, Principal, The Ehrenkrantz Group; Richard Menge, Saudi Arabian Parsons, Ltd; Roger Easley, Consultant to Battelle; Mike Gilford, Richard Meilan, and Terry Ann Nyberg with Gilford, Deringer & Company; Verna D. Hawkins, W.S. Fleming & Associates, Inc.*

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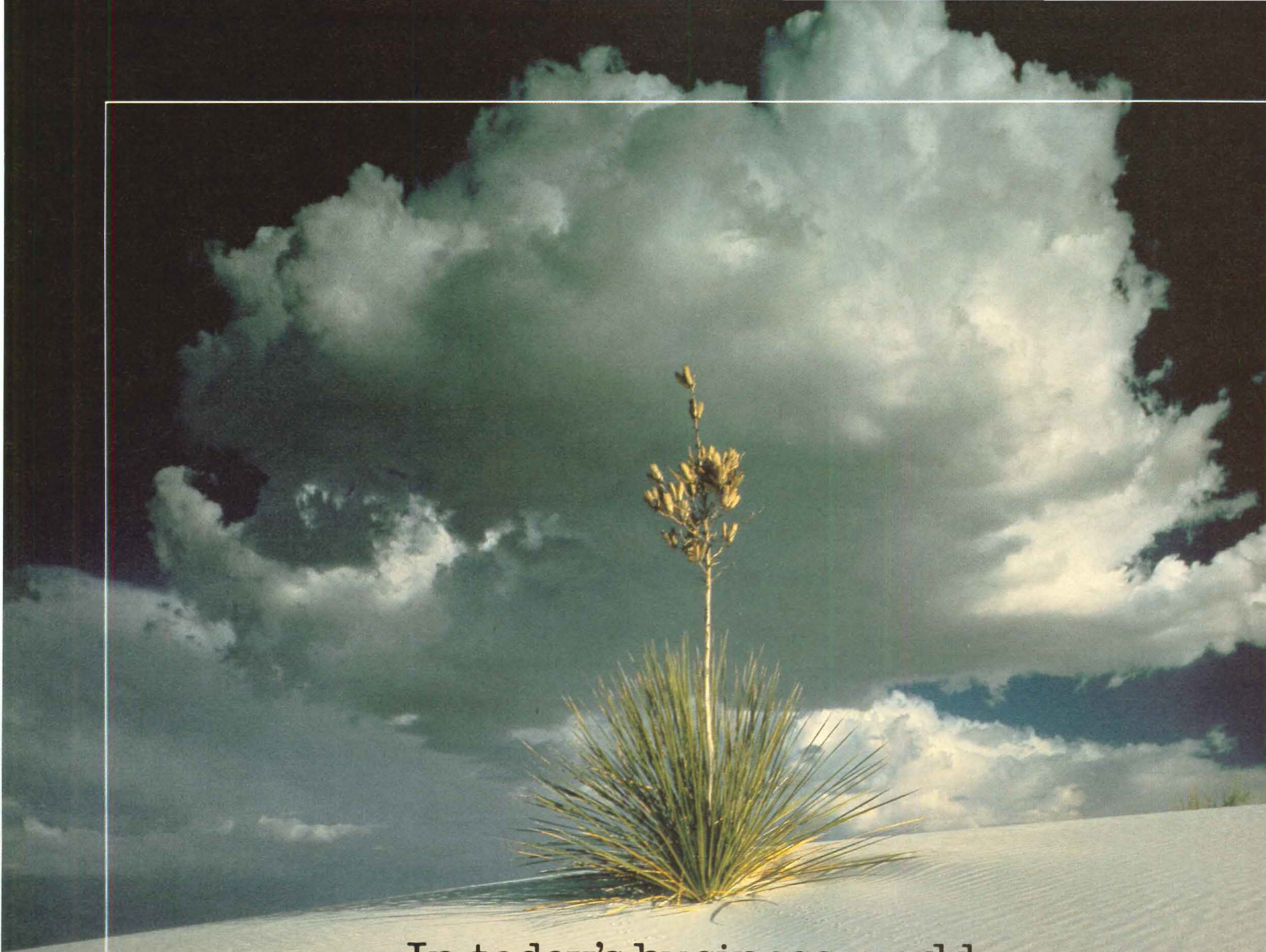

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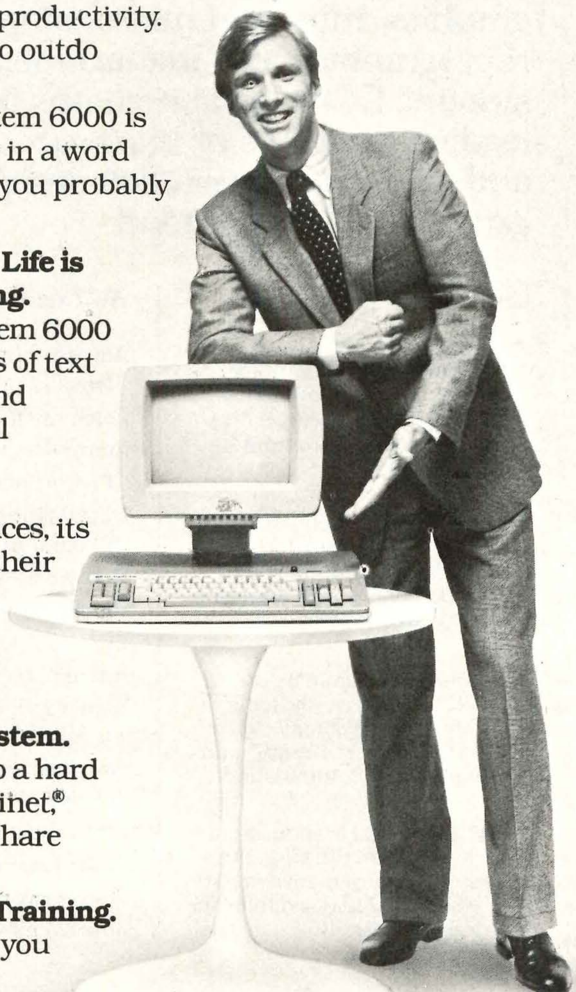

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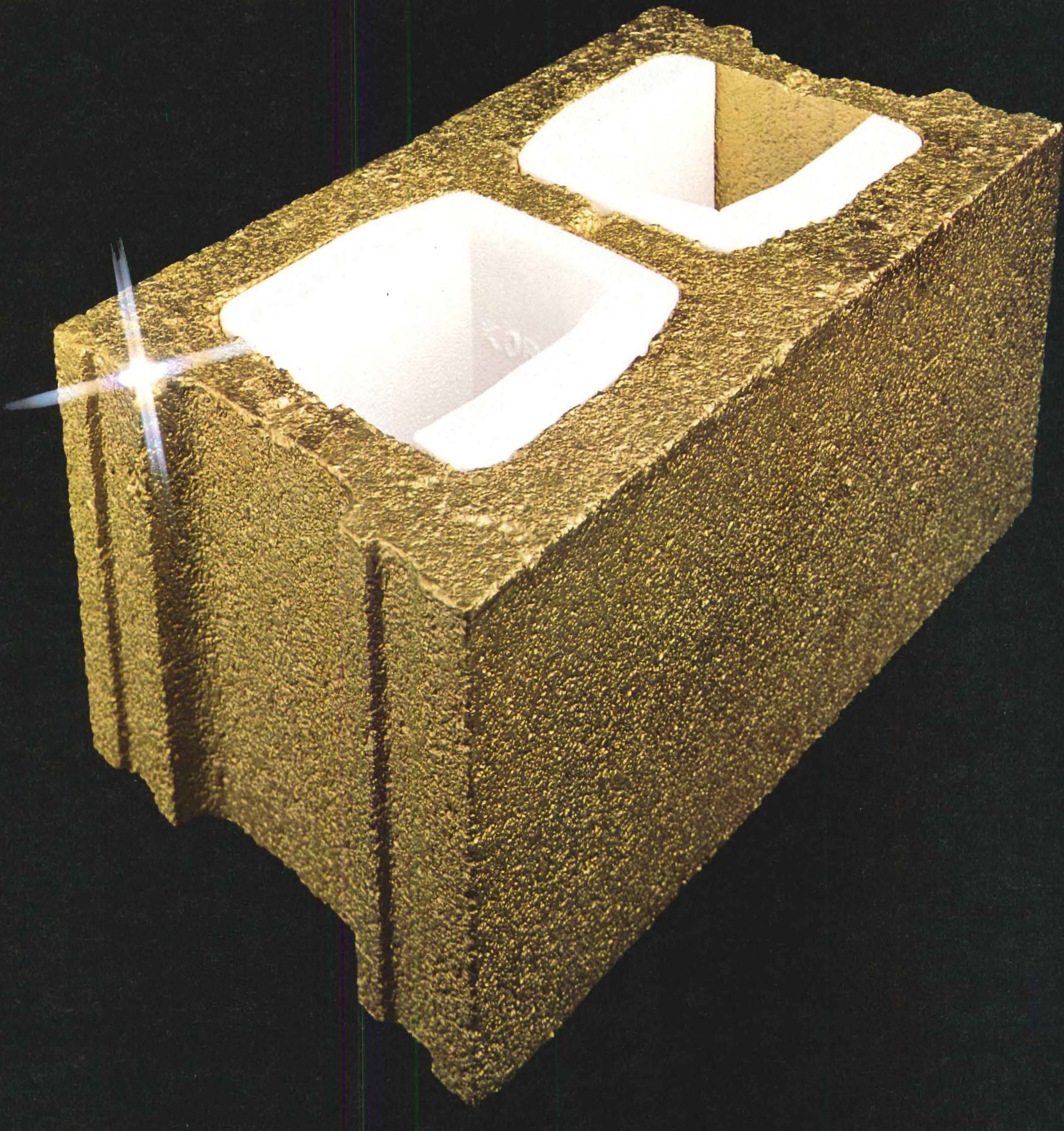

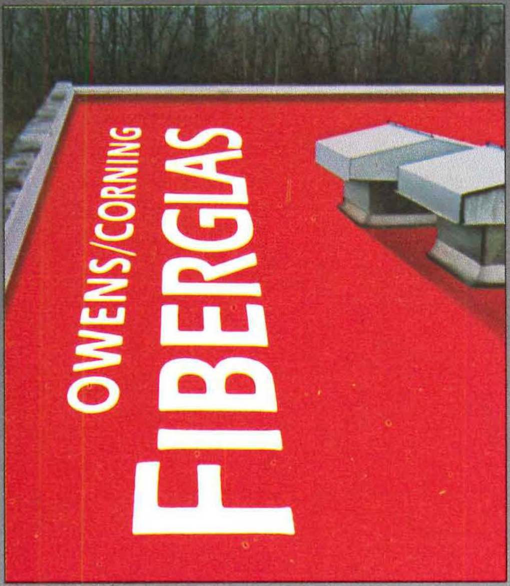

Double-layer Fiberglas insulation over FURI.
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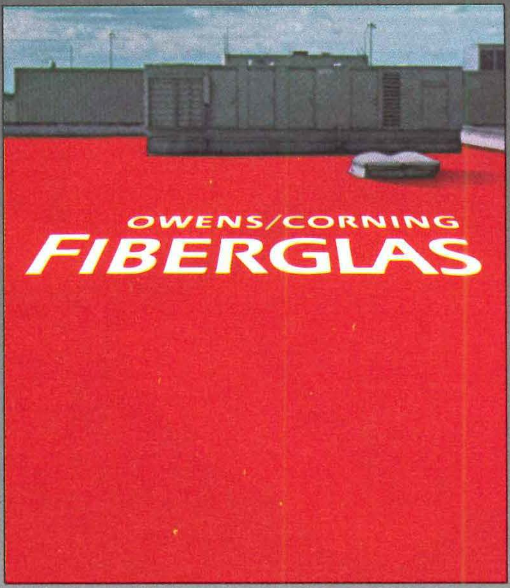
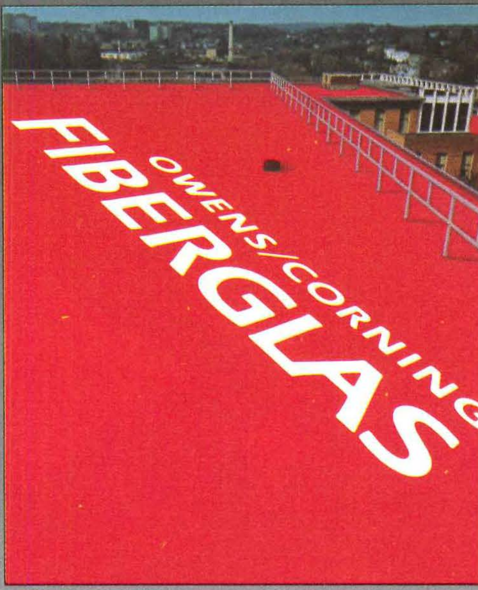
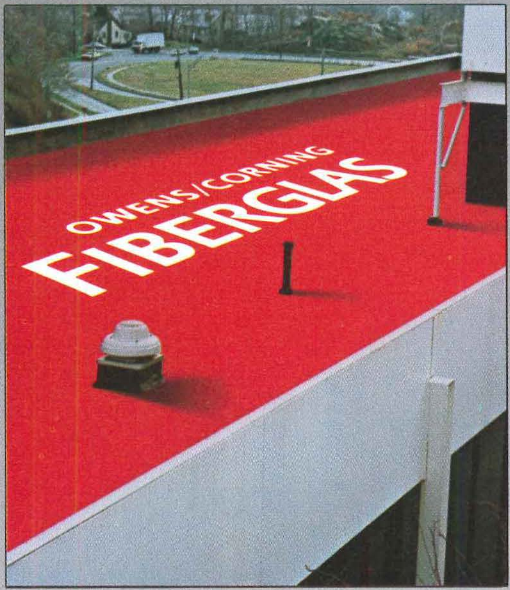


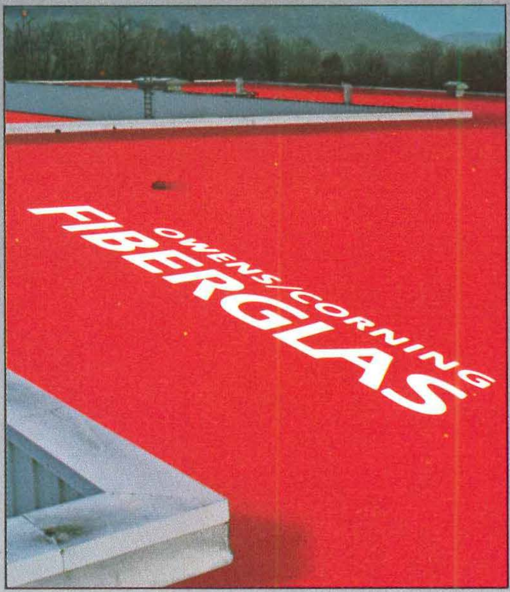
Single-layer Fiberglas insulation.
3 plies Perma Ply-R. Perma Cap® surface.



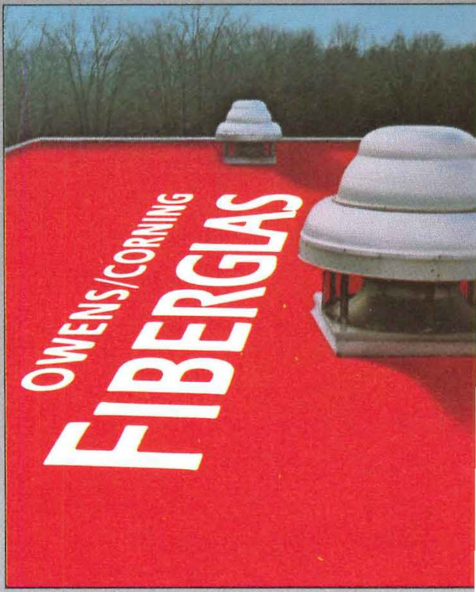
Single-layer Fiberglas insulation with taped
joints. 2 plies Perma Ply-R. Gravel surface.



Double-layer Fiberglas insulation.
4 plies Perma Ply-R. Smooth surface.*



Single-layer FURI. Perma Ply No. 28 perf. base
sheet. 2 plies Perma Ply-R. Gravel surface.



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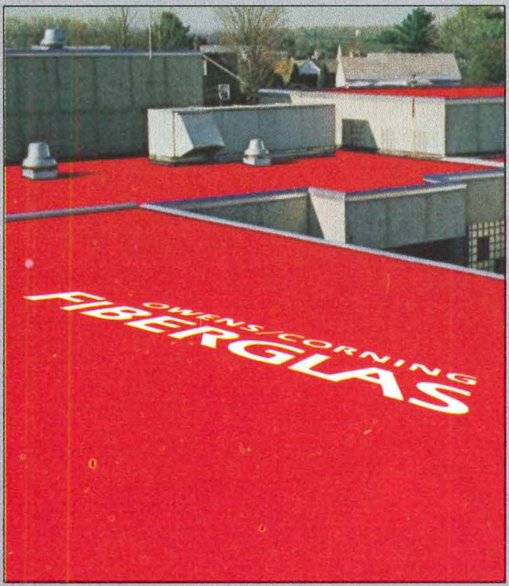
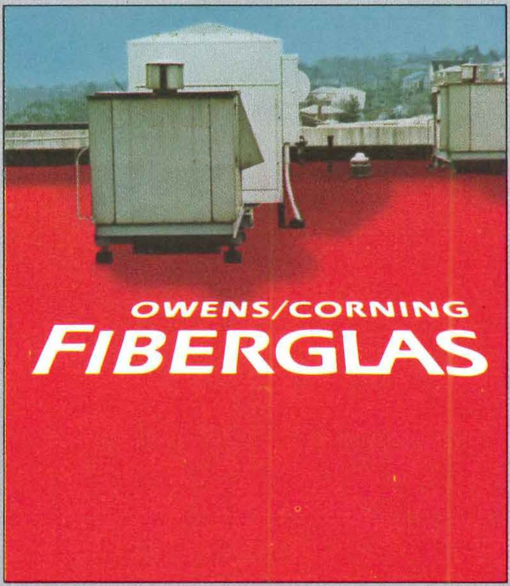
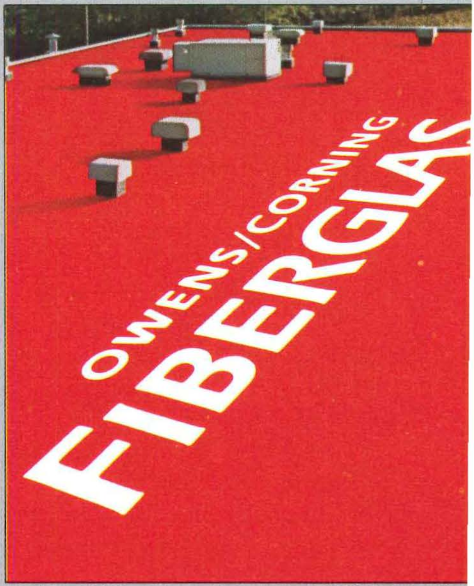
Plus-2® system.† Smooth surface.



Double-layer Fiberglas insulation. New Perma
Plus-2 system.† Gravel surface.



Single-layer Fiberglas insulation.
3 plies Perma Ply-R. Unsurfaced.



Perma Ply No. 28 base sheet. 2 plies Perma P
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A/E Systems '83

Computers keep on coming, not just in the numbers being manufactured, but in the number being used within professional design firms. The A/E Systems 83 show testifies to that. Since its initiation three years ago, the show has grown 100 percent each year in both attendance and number of exhibitors, making it the largest computer automation and reprographics event held specifically for architects and engineers. It has also become the largest single gathering of registered design professionals.

A/E Systems 83, sponsored by A/E Systems Report, will be held June 8–10, 1983, at Market Hall in Dallas. The show's offerings are varied and impressive. Some 150 exhibitors in 400 booths will include most of the automation and reprographic vendors now serving the design professions. Over 5000 architects and engineers are expected to attend, in addition to about 1500 representatives of computer hardware and software companies. Other organizations sponsoring programs during the conference are the Professional Services Management Association, with a program on "Implementing and Managing the Change to Computer Systems"; the Society for Marketing Professional Services, sponsoring "The Use of Computers in Marketing"; and the American Consulting Engineers Council, giving a one day seminar entitled "Computers: The Engineer's Competitive Edge."

Sixty-eight one-hour seminars will be given throughout the three-day conference. Included in those seminars are panel discussions on the future of computer-aided design and drafting, the use of computers in small firms, the management and financing of computers, and the use of computer graphic services. The seminar leaders represent computer and management consulting firms as well as automated architectural and engineering companies.

Seven tutorials, each three hours long, will allow a more in-depth coverage of a few topics. The tutorials will range from the basic operations of microcomputers and computer graphic systems to the use of computers in the management of a professional design firm and in systems drafting. The tutorials are a new addition to the show this year, initiated at the request of past attendees who wanted a more focused coverage of some areas.

For those already using computers, 14 one-hour discussion groups will bring together users of specific hardware or of service bureaus to exchange ideas. A design professional familiar with the particular system will lead each discussion group, with a company or service bureau representative present to answer questions. Among the companies participating are: Apple, CPT Corporation, Digital, IBM, MasterSpec, Radio Shack, Wang, and Xerox.

Other companies will hold a series of free seminars on topics that vary from telecommunications and microdrafting to systems drafting and reprographics. Those nine seminars are open on a first-come, first-served basis. Two multivendor special exhibits will give people attending A/E Systems 83 an opportunity to visualize the interaction of systems within a typical design office.

The value of A/E Systems 83 for the architect and engineer is the opportunity it gives people to gather and share information about computers. The exhibition area will be open 18 hours over the three days of the conference. Of the 50 software vendors attending the show, some will have their own booths. The remainder will display information about their products in an area of the hall designated as the software corner. In another corner, over 25 management consultants specializing in architectural and engineering services will offer free, half-hour private consultation sessions on questions related to systems selection, management, marketing, and personnel.

Awards for the most comprehensive and the most innovative use of computers by a design firm will be given. And each afternoon, a microcomputer and its accompanying software will be raffled off.

In the words of its sponsors, "A/E Systems 83 is the most effective way for the design professional to learn how computer graphics, mini- and micro-computers, reprographics, and management systems are revolutionizing the way we practice architecture and engineering." The show shouldn't be missed.

For information, write to A/E Systems 83, P.O. Box 11318, Newington, Conn. 06111 or call 800-227-1617 (in California, 800-772-3545); ask for extension 132. Watch for the official guide to A/E Systems 83 in the May issue of P/A.

Specifications clinic

From manufacturer's data into specifications

Walter Rosenfeld

Even with the help of CSI-sponsored documents, product information provided by manufacturers can seldom be transformed into specifications without additional work by the specifier.

As part of their sales programs, manufacturers of construction products have always provided descriptive literature and product data to inform prospective users of the characteristics and virtues of their materials. Traditionally, specifiers have relied heavily on such literature in preparing specifications for building projects. Before the days of industry-wide master specifications, "writing from scratch," using this kind of data, was the norm for both new materials and new applications of familiar materials and took a lot of the specifier's time and energy.

The trouble with most manufacturers' handouts and catalog information was their sales orientation. Limitations on use were seldom indicated, and needed technical data were often omitted. Incomplete or missing installation information frequently presented problems, and the data each manufacturer chose to supply were often different from those of competitors, which made comparison of characteristics, construction, and performance quite difficult. No general standards for format or content of manufacturers' literature existed until CSI introduced Spec-Data to deal with the situation.

In the words of James Sigel, current manager of this very successful program, "Spec-Data is a product bulletin, condensed to eliminate extraneous materials and promotional language. All data are arranged into ten standard categories: product name, manufacturer, description, technical data, installation, availability and costs, guarantee, maintenance, technical services, and filing systems. This standard arrangement aids product comparisons and locating specific information." While use of Spec-Data sheets reduces the time needed for research and telephone calls to manufacturers when transforming product information into specifications, a great deal of "writing from scratch" is still required because of the way the data are structured.

Can more be done to speed the process? The next logical step beyond Spec-Data has already been taken: Under the CSI Manu-Spec program, the manufacturer drafts a sample specification for the specifier's use. As Sigel puts it, "Manu-Spec is a prepared specification section written in the CSI three-part format, but for a manufacturer's specific product. It shows the way a manufacturer's product should be specified." Thus a Manu-Spec for a chosen product can be rather easily transformed into a narrow-scope section for a particular project manual or incorporated into a broader scope section, which includes it among other products.

Is this the end of specifying as we have known it? Hardly. For among the things neither CSI nor the manufacturer can do for us is choose the appropriate products for the project and decide what characteristics we want in the products we select. Frequently one product alone is not enough for a competitive situation where the contractor, too, must be given a chance to choose. And of course, each project has its own requirements and rules, to which the specifications must be adapted.

While a large number and a great variety of products are covered by Spec-Data, fewer Manu-Specs have been written so far. One hopes this program will also prosper and multiply. But for product groups and processes not completely covered by either Spec-Data or Manu-Spec, CSI does offer another service: the Technical Aids Series (TAS), which describes the resources, documents, and information available to the researcher of building components and materials. Each TAS document covers one category and lists all applicable standards and regulations, available specification aids (such as those mentioned above), institute and association publications, related books and periodicals, and all known manufacturers. It is a complete bibliography of the essential information needed to prepare a specification, and is thus of great time-saving value.

But no matter what form product information may take, the specifier still has to get the project manual organized and written. He still must make sure that the appropriate products are properly specified and closely coordinated. When resource materials don't have the answer, he must still consult directly with manufacturers' representatives to get the information he needs. And in spite of all the documentary help available, specifiers surprisingly still find products, applications, and variations that are not adequately described, that still require "writing from scratch" new descriptions, new instructions, or new sections on many of their projects.

Even today, turning product information into specifications continues to be one of the basic activities of the specifier. It's a lot easier now because of CSI-sponsored documents, but it still requires experience, skill, and good judgment, as all specifying does.

Walter Rosenfeld, *AIA, CSI, is Managing Director for Professional and Technical Services at The Architects Collaborative in Cambridge, Mass.*

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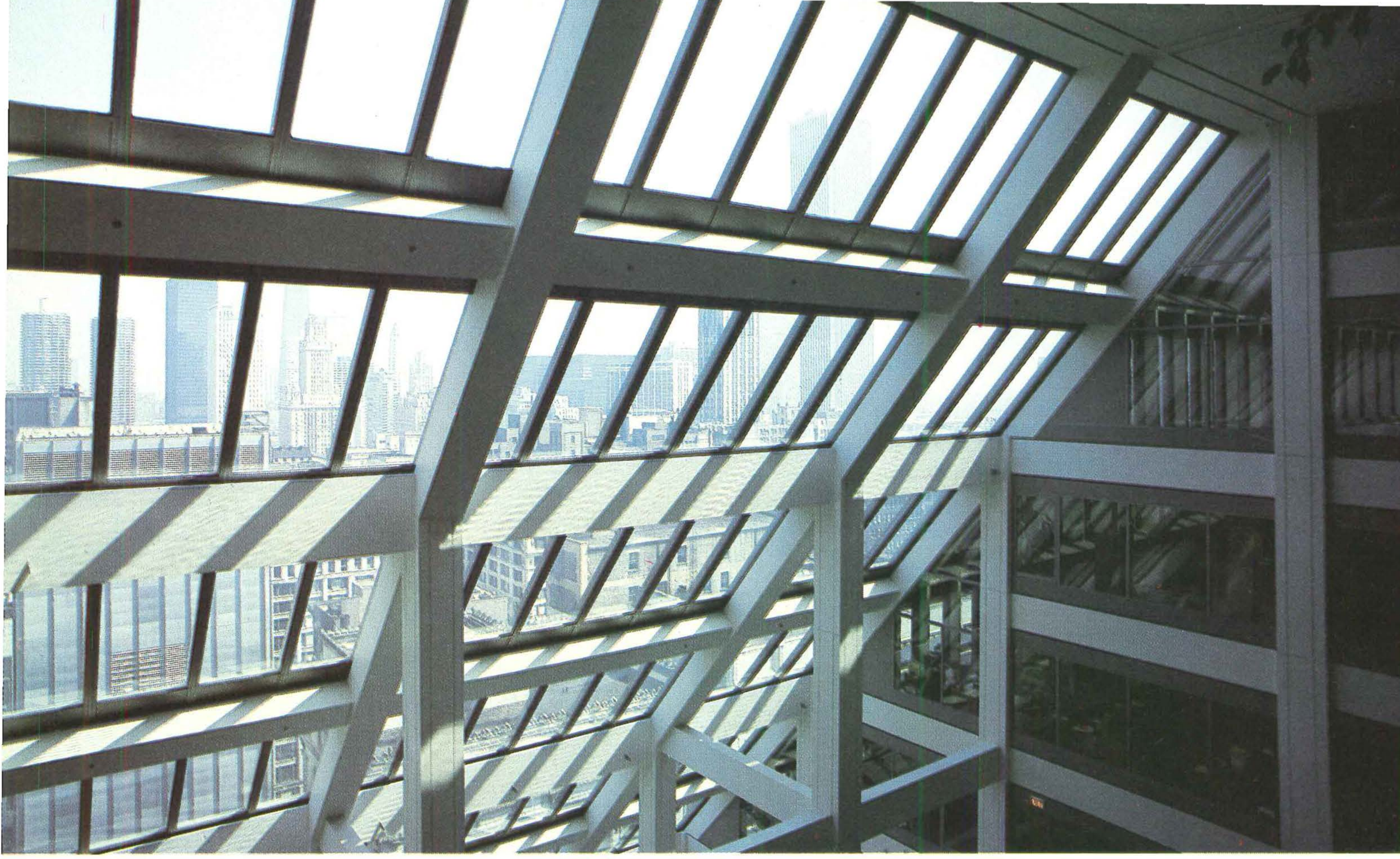

Chicago's dramatic 33 West Monroe building was designed by Skidmore, Owings & Merrill and is managed by Draper and Kramer.

How Laminated Glass helped move the great outdoors upstairs.

It was an inspired idea.

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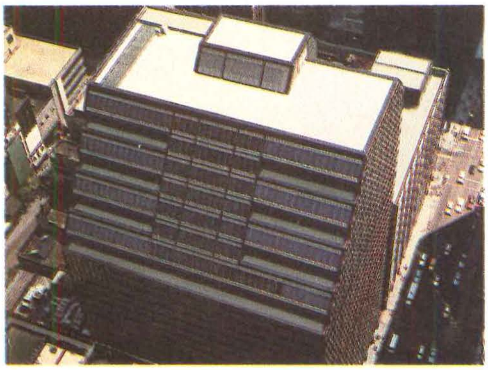

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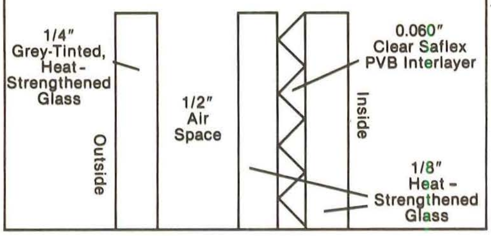

This configuration provides the following performance characteristics:

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Ruling sets precedent affecting zoning laws

Norman Coplan

A New Jersey court ruling requiring municipalities to provide low-income and moderate-income housing sets a precedent that could result in major land use changes.

In 1975, the New Jersey Supreme Court ruled, in a dramatic and precedent-shattering case, that the town of Mount Laurel's zoning ordinance, whose practical economic effect was to exclude low-income and minority groups from residence in the municipality, violated the New Jersey Constitution (*Southern Burlington County NAACP, et al.* v. *Mount Laurel;* see "It's the Law," P/A, Aug. and Sept. 1975). The court ruled that every municipality was required under its land use regulations to make realistically possible an appropriate variety and choice of housing. No municipality, stated the court, may foreclose the opportunity for low- and moderate-income housing, but rather must affirmatively afford that opportunity to the extent of the municipality's fair share of present and prospective regional needs.

Following this decision, however, very little change occurred in land use in the town of Mount Laurel, and although some acreage was set aside for moderate- and low-income housing, such housing was never developed. As a consequence, the highest court of New Jersey was again called upon to rule on the validity of the Mount Laurel zoning ordinance, as well as the zoning statutes of several other New Jersey communities. In 1983, the court handed down another dramatic and precedent-setting decision, which may affect the zoning laws of communities throughout the United States. The court ruled that municipalities were constitutionally required not only to change their zoning ordinances to provide areas for low- and moderate-income housing, but that such municipalities were obligated to provide tax or other incentives, which would encourage and make it economically feasible for private developers to build such housing and/or to require low-income units to be included in upper-income projects.

Mount Laurel is a suburb of Philadelphia consisting of one-family homes, farms, woods, orchards, and back roads. Its population is approximately 17,000, and it comprises 14,176 acres, of which approximately 58 percent is undeveloped. There is no concentrated business area in the town. In the master plan, it was contemplated that the bulk of its growth would be in clusters known as planned unit developments, which were to be a mix of townhouses, garden apartments, and multistoried structures. The proposed cluster housing, when fully developed, would utilize approximately 30 percent of the town's acreage; the other 70 percent would remain open space. The residents were, for the most part, professionals, businessmen, and farmers who were united in opposition to the open housing plans current in the 1970s. Consequently, there was no enthusiasm for the development of low-income housing.

When the New Jersey Supreme Court invalidated the zoning ordinance in 1975, the town's response was to rezone three widely separate plots totaling 33 acres. It was apparently the town's contemplation or hope that approximately 515 new units would be constructed on this acreage and that thereby the court's requirements would be satisfied. These plots were owned by separate individuals or companies, however, who apparently had no interest in either developing the property for low-income housing or in selling it. As a consequence, no low-income housing was developed.

Following the 1975 court decision, the courts in New Jersey were inundated with litigation challenging the zoning ordinances of various communities. In reaction to this litigation and to the lack of any program by the town of Mount Laurel to develop low-income housing, the Supreme Court of New Jersey consolidated several of these cases into one proceeding and considered it for a period of over two years before issuing a decision in 1983. The concern for the social issue involved was reflected in the court's description of the actions, or lack thereof, of the town of Mount Laurel. It stated:

"After all this time, Mount Laurel remains afflicted with a blatantly exclusionary ordinance. . . . Papered over with studies, rationalized by hired experts, the ordinance at its core is true to nothing but Mount Laurel's determination to exclude the poor. . . . We have learned from experience that unless a strong hand is used, Mount Laurel will not result in housing, but in paper, process, witnesses, trials and appeals."

The general thrust of the decision is to require the municipalities to do whatever is necessary to insure that housing for the poor will actually be built. The remedy to the problem prescribed by the court is to require communities to provide tax or zoning incentives, to provide assistance to developers in applying for Federal aid, and to require developers of high-income projects to include low-income units in their projects. Further, in order to simplify and avoid costly and time-consuming litigation, the court provided that issues relating to exclusionary zoning be determined by specially qualified judges, and that a planning study, known as the New Jersey State Development Guide Plan, be used to determine the fair share of regional needs for low- and moderate-income housing to be borne by the various municipalities of the state.

Critics of the decision argue that the court has usurped the function of the legislature, and that its decision reflects its own concerns and social consciousness relative to the lack of low-income housing. This decision is bound to have a strong influence on the determinations of courts in other states, and if followed, will result in a revolutionary change in land use patterns in the United States. □

Norman Coplan, *Hon. AIA, is a member of the law firm Bernstein, Weiss, Coplan, Weinstein & Lake, New York.*

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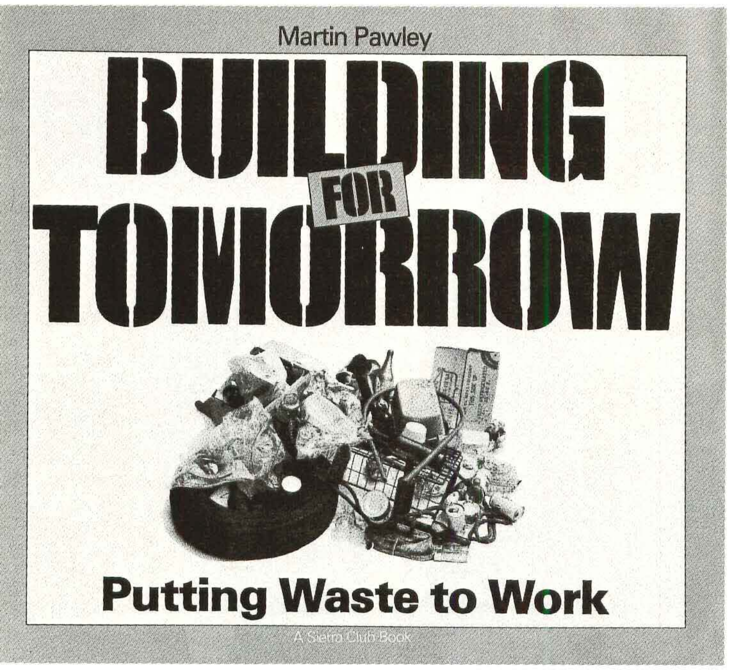
Waste used

Books



Building for Tomorrow: Putting Waste to Work *by Martin Pawley. San Francisco, Sierra Club Books, 1982, 192 pp., $17.95.*

Reviewed by James Marston Fitch, Director of the Department of Historic Preservation, Beyer, Blinder, Belle, and Professor Emeritus and Director Emeritus, Department of Historic Preservation, Graduate School of Architecture and Planning, Columbia University, New York.

This is an authentically idiosyncratic book. Nominally it is a do-it-yourself handbook on how to reuse fabricated waste artifacts—automobile tires, beer cans, pop bottles, cardboard tubing, and the like—in the construction of buildings. But the fact that it is published by the Sierra Club suggests that it has more serious ambitions; and so indeed it has, as a reading of the text will quickly prove. The paradox comes from the case histories that the author, the Anglo-Canadian architect Martin Pawley, insists on using to illustrate his points. These consist of an almost comically awkward collection of small structures fabricated of cans, tubes, and tires. Since all of the artifacts have a circular, tubular, or domical geometry and all of them are very positively discrete and independent, it requires inordinate ingenuity to assemble them into special entities that are even arguably habitable.

The paradox is one of Pawley's own making since he insists, on very meager evidence, that it is more economical "to build with wastes as they are instead of processing them into special building materials at giant municipal plants" (p. 115). It is of course obvious that it takes additional energy to reprocess aluminum cans into aluminum nails or siding. But the trade-off between embodied energy saved by building an awkward igloo of cans, along with the enormous amount of human energy required to assemble such an unstable shape, and the amount of energy required to heat or cool it during a predictably short and unsatisfactory life, seems to argue against Pawley's position.

He says that the use of waste products should, as far as possible, take place without preliminary energy-consuming industrial processing. That is to say, "building with bottles makes more sense than smashing bottles, color sorting the glass and melting it down and making special glass buildings [*Books continued on page 161*] comforto®

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ooks continued from page 159

rom it" (p. 15). It makes more sense only if one is dealing ith a single and primitive building type of the sort Pawley nd his students have built.

As the man who is simultaneously giving us a chillingly ıcid account of waste in contemporary American society, awley the architect is offering a singularly unconvincing ıeory for handling this waste. Thus, in two tables (19 and 20) e is contrasting the net energy intensity of a wall built of luminum cans and a wall built of traditional building eleıents of reprocessed aluminum—but he neglects to give us ıe on-site labor involved in either system! His argument is ıeoretically even weaker when treating the broader aspects f waste conservation. How can the energy embodied in garage and sewage be recovered except by the investment of ill more energy, since neither form can be used in its raw ate? (In order to fully industrialize their sugar cane industry, ıe Cubans have been forced to convert from simply burning ıe waste *bagasse* to a series of processes producing alcohol, aper, building board, *and* fuel for the boilers.)

It is a pleasant surprise to turn from Pawley's architectural ase histories to his text, which is a perceptive argument for a hole new national attitude toward the very concept of waste." Thus he reminds us that "because matter is indeructible, what we conceive to be the creation of waste is, in eality, the incomplete transformation of matter . . . what we eally mean (by the word waste) is the conversion of useful aw materials into *useless* or *inaccessible* ones by the operation f the economy" (p. 41).

In the chapter entitled "Toward a Ruthless Product Enviɔnment," Pawley draws analogies from the natural world alculated to drive the proponents of Reagonomics into an arly grave. In nature, he points out, the development and urvival of organisms is controlled by the rigors of the enviɔnment in which they evolve. In earlier primitive and preinustrial societies, similar restraints operated in the genetic volution of tools and artifacts. But such societal controls have isappeared in a world increasingly dominated by internaonal cartels. They control "the genetic pool" of technological ıvention and development. But their vested interests dictate ıe suppression of all but the tiniest sector that happens, at ny given moment, to be the biggest profit-maker. Thus the ıternal combustion motor is promoted at the expense of all ther means of locomotion, and the voltaic cell is suppressed xcept in space, though the patents are controlled by the same ɔrporations.

Pawley proposes a new Department of *Product Evolution* to ɔrrect this situation: "Armed with computer-modeled data n the totality of resources, production and reproduction caabilities, life-cycle costings and waste-disposal operations . . . ıch an organization would have at its fingertips an immense esigning and planning capability, covering all patents held . . its mode of technology assessment would be governed by ue energy calculations, incorporating embodied, direct, perating and disposal elements all freely traded off one gainst the other in pursuit of an optimal energy budget" (p. 54).

Pawley confesses that "with the experience of recent years it difficult to conceive of regulatory agencies as a source of ɔnomy and efficiency." But he nails the argument down ith the warning that "it is futile for industry to argue against ·gulation because no other principle than regulation opertes in nature: there is no alternative because no alternative xists." Mr. Pawley is here using a geologic, not a human, me-scale, and he is certainly right. Perhaps his argument will em even more convincing if he can be persuaded to omit all s illustrations from the next edition. ☐

ther pertinent titles

arth-Sheltered Habitat, History, Architecture and Urban esign *by Gideon S. Golany. Van Nostrand Reinhold Company, ew York, 1983, illus., 240 pp., cloth $21.95, paper $14.95.*

ırth-Sheltered Habitat, intended for social scientists and ɔnomists as well as architects and engineers, provides a

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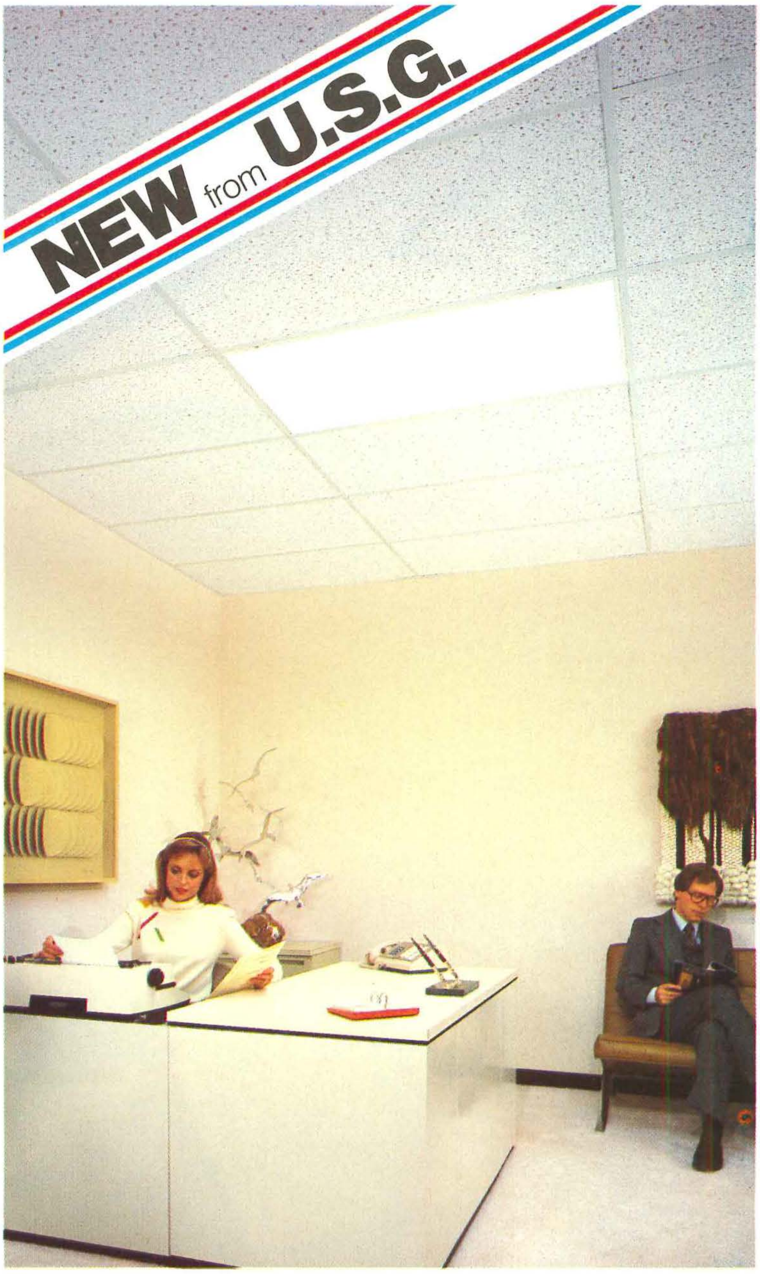


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ooks continued from page 161

omprehensive if somewhat general introduction to subterranean structures. Although it briefly reviews historical and nodern examples of that building type and sketches their rban design potential, the book's strength lies in its coverage f the architectural design implications of earth sheltering, ith a thorough analysis of soil conditions, site considerations, nd ventilation techniques, and with more than a passing recgnition of the psychological and legal hurdles that still exist. here are few plans and construction details, and some of the rawings, such as the possible shapes of windows, are pointss. The book, nevertheless, remains a valuable reference, orth owning by anyone at all interested in earth-sheltered esign.

assive Solar Architecture, Logic and Beauty *by David Wright nd Dennis A. Andrejko. Van Nostrand Reinhold Company, New ork, 1982, illus., 255 pp., cloth $24.95, paper $16.95.*

he authors of this book had two objectives, made clear in its ubtitle. The first is to show, through the example of 35 ouses located in almost every climatic region in the country, ow energy-conscious design follows some basic principles hat were a part of every architect's working knowledge until his century. That is the logic. The second objective—eauty—is to show how those principles can be integrated into coherent architectural design. Not every house is quite as eautiful as one might hope, but the book's format, with crisp hotographs, consistently drawn plans and sections, and clear roject summaries, shows each to its best advantage. For those ooking for design ideas that incorporate passive solar strategies, the book is most useful.

Veather and Energy *by Bruce Schwoegler and Michael McClinck. McGraw-Hill Book Company, New York, 1981, illus., 230 pp., 22.50.*

Veather systems contain enormous amounts of energy, which e need only harness through technology. So runs the basic remise of this book, the first half of which explains how eather systems work and the second half, how emerging chnology might best utilize the energy of the sun, the wind, e rivers, the ocean, and the trees. The book makes good ackground reading on the macroclimate and on new energy chnologies, but it has little in the way of specific archictural applications or guidance.

ive Degrees of Conservation, A Graphic Analysis of nergy Alternatives for a Northern Climate *by Lance LaVine, ary Fagerson, and Sharon Roe. University of Minnesota Press, inneapolis, Minn., 1982, illus., cloth $19.50, paper $10.95.*

carefully documented research report on the performance five energy-conscious houses in Minnesota, this publication emonstrates, among other things, that superinsulation is one the most, and active solar space heating one of the least, ost-effective ways to conserve energy. The research suffers, hough, in its presentation. There are two many redundant raphs and axonometrics and too little detailed information bout the houses to be of use to most architects.

olar Architecture, The Direct Gain Approach *by Timothy E. hnson. McGraw-Hill Book Company, New York, 1981, illus., 218 ., $21.50.*

ot for those who fear calculations, this book contains a ealth of reference material on the design of direct gain buildgs, from the placement of vegetation and interior partitions the sizing of windows, the detailing of glazing, and the ontrol of glare. It offers a direct gain design method and nds with appendices on calculator programs, climatic and esign data, and a sample heat loss calculation. Recomended.

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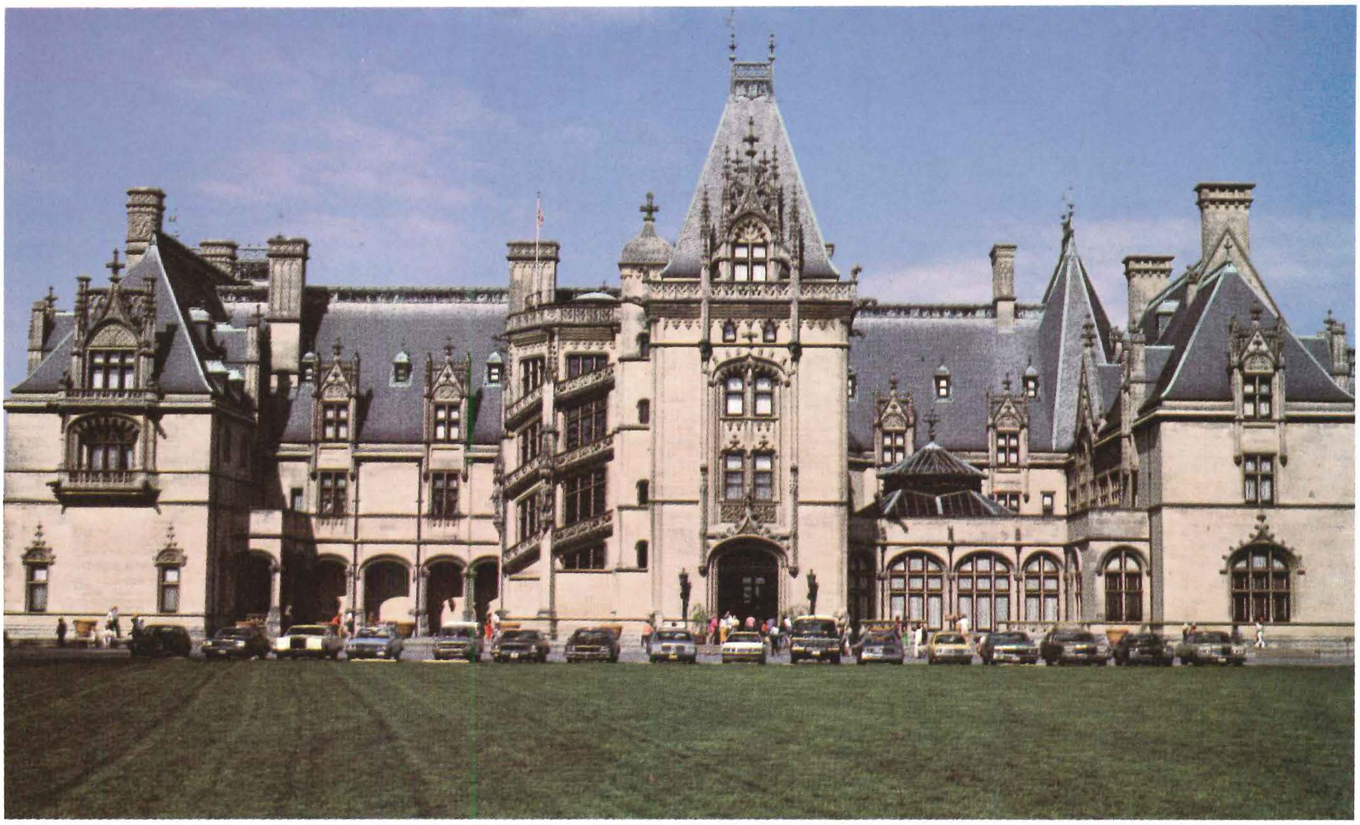

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Biltmore House, near Asheville, North Carolina, was designed for G. W. Vanderbilt by Richard Morris Hunt, a founder of the American Institute of Architects. The house is the world's largest privately owned residence. Completed in 1895, this national historic landmark was opened to the public in 1930 and has become one of the most popular tourist attractions in the South. A large number of rooms are open for the public to enjoy the art treasures and other contents, many of them priceless antiques.

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Products and literature

he following items are related to the eneral theme of this issue, conserva- on of energy and resources.

Vater conservation Products

Litchen faucets in the 7300-A series in- lude the Flow-Rater™ aerator, to con- rol water flow to 2.5 gallons per minute, nd a Temperature Memory that ad- ısts water temperature gradually. Con- rol handle and 9-inch-long spout are hromium-plated brass. Stanadyne, nc., Moen Div.
ircle 100 on reader service card

lub Shower for health clubs and ath- tic facilities conserves water by auto- ıatically shutting off flow after a preset ngth of time. A thermostatic mixing ılve provides water at a constant tem- erature no higher than 107 F. The ıetering valve, which is adjustable from to 60 seconds, is activated by less than ›ur pounds of pressure. Club Shower is ade from heavy gauge stainless steel ıd includes a recessed stainless steel ›ap tray. Bradley Corp.
rcle 101 on reader service card

Literature

Metering faucet 90-75 delivers a consistent 10-second cycle of water flow totaling .125 gallon at 80 psi line pressure. It is activated by only 4 pounds of pressure, compared with 20 pounds required for some units, making its operation easier for the handicapped. A spray diffuser spreads the water to provide satisfactory hand-washing performance. Timing is field adjustable from 5 to 15 seconds. Description and illustration of the faucet are included in an eight-page brochure, "Plumbing Fixtures." Bradley Corp.
Circle 200 on reader service card

The Superinse® toilet, described in a data sheet, flushes completely and quietly with just one gallon of water—about 20 percent of the amount used in conventional toilets, according to the manufacturer. An antisiphon fill valve and conventional flush valve are its only moving parts. Superinse can be used with existing plumbing and requires no air or electrical connections. Thetford Corp.
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Cascade toilets, manufactured in Sweden use very low water volume. Model 3250 uses only .8 gallon of water, yet operates quickly and efficiently. Models 3260 (visible "S" trap), 3300 (concealed trap), and 3293 (wall hung) use 1.6 gallons per flush. They are made of polished vitreous china, with acetal plastic working parts and polypropylene seat. Rough-in dimensions are different from those for U.S.-made units, but retrofits are possible. A four-page brochure illustrates methods of new or retrofit installation and includes charts of water savings possible and colors available. Ifö Sanitär AB.
Circle 202 on reader service card

Water-Saver toilets that operate with 3.5 gallons of water, 30 percent less than regular toilets, save both fresh water use and wastewater processing. The water-saver feature is available in several models, which are described and illustrated in a 12-page brochure, and include Cadet, Plebe, Roma, and Elissa. American-Standard, Inc.
Circle 203 on reader service card

Water Economy toilets operate with only 3.5 gallons of water, yet are said to operate as efficiently as conventional units, which require as much as five or six gallons. Tanks are equipped with insulating linings that eliminate condensation that otherwise might form on tank exteriors. A four-page brochure describes the Water Economy toilets and the Neu-Hygiene bidet. Crane Co.
Circle 204 on reader service card

Water-Guard faucets are equipped with aerators to control flow and reduce water consumption. Finishes include brushed or polished chromium, brushed or polished 24-carat gold, and polished or burnished brass. Several designs for lavatory, bath/shower, and kitchen are illustrated and described in a 28-page color brochure that also includes information about Water-Guard, valve features, and Rite-Temp temperature control. Kohler Co.
Circle 205 on reader service card

Faucets for lavatory, tub/shower, and kitchen, illustrated and described in a 14-page color brochure, include models with water-saving features. Many are equipped with aerators having 2.5-gallon-per-minute flow restrictors. There are models to blend with any style. American-Standard, Inc.
Circle 206 on reader service card

'Selecting the Proper Flushing System' compares Sloan's Flushometer with tank-type installations. Factors considered in the 14-page brochure are aesthetics, noise level, maintenance, water/sewer cost savings, performance and reliability, initial costs, and life-cycle costs. A case history of a 192-unit hotel/motel charts a 25-year, $56,770 cost saving. Sloan Valve Co.
Circle 207 on reader service card

Air quality products

The Talking Gastechtor talks to the user by means of a simulated-voice chip. It leads the user through steps to operate the device. In the event that it detects high concentrations of gas, the user is warned to leave the area. The warning is followed by a continuous sound that varies depending on the degree of emergency. GasTech, Inc.
Circle 102 on reader service card

Gas monitor Model 2321 is a rack-mounted multipoint system for continuously monitoring up to 16 locations.
[*Products continued on page 168*]

Products continued from page 167

Each channel has an individual meter display. Modules available can monitor oxygen, combustible gases, carbon monoxide, and hydrogen sulfide. They have individual relays and high and low alarms. GasTech, Inc.
Circle 103 on reader service card

A personal carbon monoxide alarm monitor is equipped with audible and visible alarms, and has earphones available for use in noisy areas. The continuous concentration display is made possible by the use of a low-power CMOS analog to digital converter/display driver. The unit, measuring 6″ x 3″ x 2″, is enclosed in a rugged case and has a long-life battery. The display space indicates when the battery has only eight hours of life remaining. The leather carrying case comes with a belt loop for easy portability. Interscan Corp.
Circle 104 on reader service card

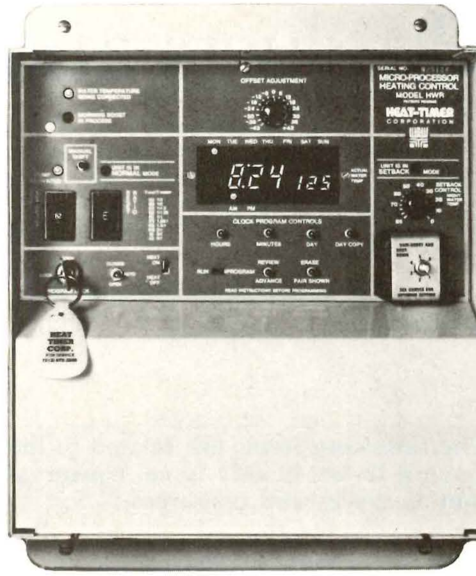
The Miniram personal dust monitor measures dust concentrations sampled from natural air convection. Designed for on-person use, it weighs only 14 oz and measures 4″ x 4″ x 2″, making it suitable for carrying on a belt, hard hat, or shoulder strap. A brochure describes the monitor, its performance, and electronic controls and includes information about accessories and prices. GCA/Technology Div.
Circle 105 on reader service card

Track Etch® radon detector measures the average radon level in home or office. Attached to a wall in one or two locations, it registers radiation from radon in the air. At the end of approximately three months, it is returned to the company for processing and analysis. A six-page leaflet discusses radon, its sources and effects, and outlines the features of the detector. Terradex Corp.
Circle 106 on reader service card

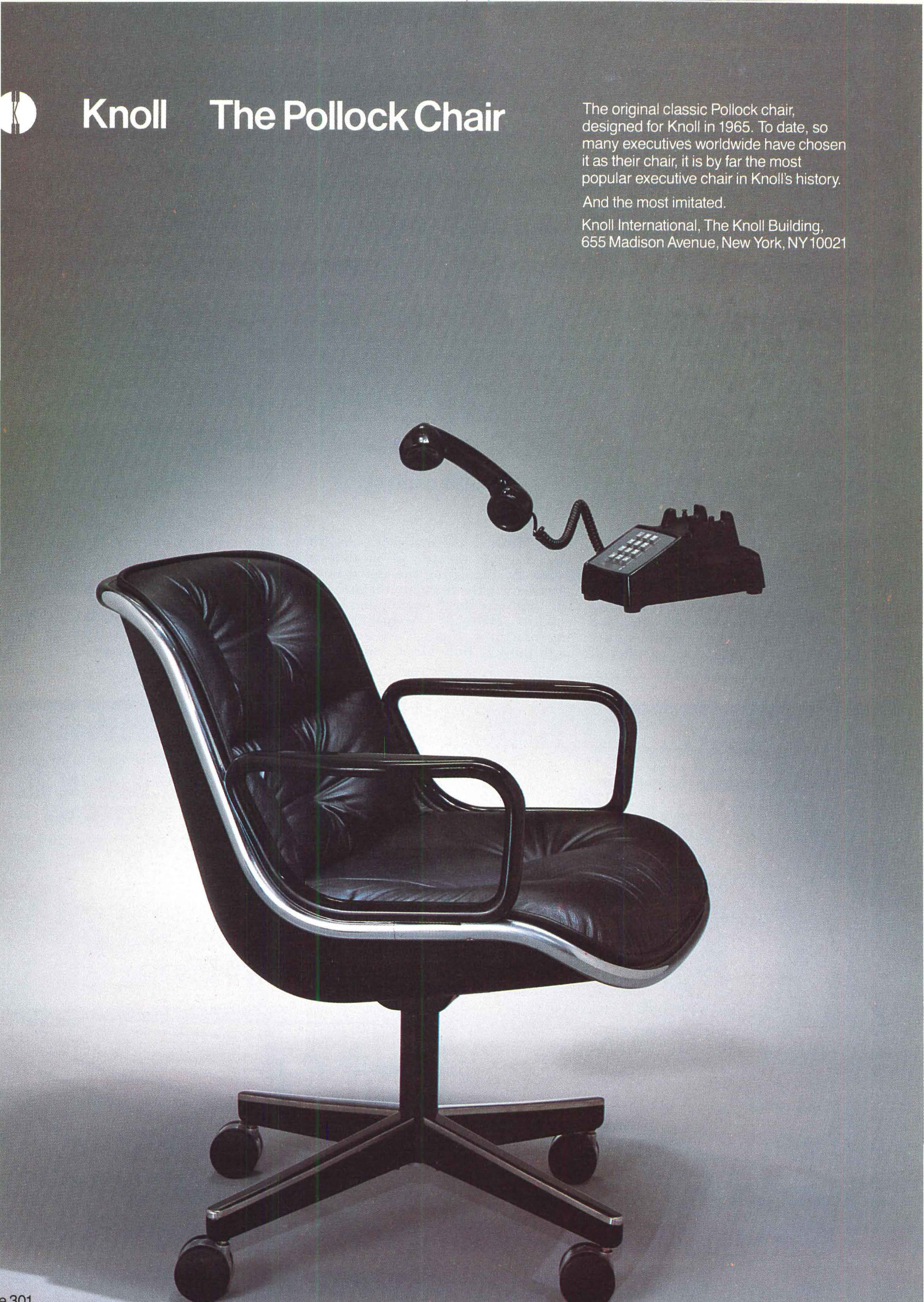
HVAC control products

NTZ and NTLZ remote sensor thermostats save energy by controlling hot water or steam heat in baseboard radiation, convectors, and freestanding radiators. The thermostats are not electric, but operate on a temperature-sensing wax element that expands or contracts to operate an actuator that opens or closes the valve. A dial allows the user to select the desired room temperature. They are said to be suitable for use in schools, offices, apartments, and hotels. Macon Control Corp.
Circle 107 on reader service card

Excel direct control for heating, ventilation, and air-conditioning systems uses microprocessor technology and software logic to provide efficient building energy management. A single controller can handle one or several HVAC systems. The software has the flexibility to change functions with changing hardware, wiring, or piping. Honeywell, Inc.
Circle 108 on reader service card



Microprocessor heating control Mode HWR is designed for hot water system in apartment houses, office buildings industrial plants, and institutions. It ha a seven-day electronic clock that time space temperature levels to meet occu pancy schedules. Eight heat leve changes can be made each day, and eacl day can be programmed differently Depending upon the type of control i replaces, it can save from 15 to 30 pe cent of fuel used. Heat-Timer Corp.
Circle 109 on reader service card
[*Products continued on page 170*]


Knoll The Pollock Chair
The original classic Pollock chair, designed for Knoll in 1965. To date, so many executives worldwide have chosen it as their chair, it is by far the most popular executive chair in Knoll's history.
And the most imitated.
Knoll International, The Knoll Building, 655 Madison Avenue, New York, NY 10021

Products continued from page 168

Power/Perfect 4500 microprocessor-based energy management system integrates four energy-saving controls: Programmed start/stop, Load cycling, Demand limiting, and Optional start/stop. It is expandable from single-building to multi-building monitoring by connecting remote units to a central terminal using nondedicated telephone lines. Johnson Controls.
Circle 110 on reader service card

Temp-Mi$er energy management system, with eight analog temperature sensors, controls HVAC equipment through optimum start operation. Data from indoor and outdoor temperature sensors determine start times and avoid unnecessary equipment operation. The system is programmable for time-of-day and day-of-week schedules, with holidays planned up to a year in advance and special scheduling up to a week in advance. It has battery backup and audible alarm. MicroControl Systems, Inc.
Circle 111 on reader service card

Compustat II digital setback thermostat for industrial/commercial applications combines seven-day independent scheduling and automatic heating/cooling changeover. One or two set-up and set-back periods can be scheduled for each of seven days. Temperature control is maintained at an accuracy of ±0.5 F. The thermostat can replace most 24–30-volt single-stage thermostats with no additional wiring. Compustat II is available in heating only or heating/cooling models. PSG Industries, Inc.
Circle 112 on reader service card

Enerstat™ microcomputer thermostat for residential use automatically adjusts temperature levels four times a day to meet occupancy schedules. For use with furnace or air conditioner, Enerstat allows adjustment of the temperature span to reduce on/off cycles. By reducing temperatures during unoccupied periods and sleeping periods, savings can amount to as much as 30 percent during the heating season and 25 percent during the cooling season. It easily replaces an existing thermostat; if location is a problem, there is a remote sensor available, which can be placed in the most effective location. Valera Electronics, Inc.
Circle 113 on reader service card

Lighting and controls Products

Bulb-Miser, a thermal-shock-absorbing disc, extends the life of incandescent bulbs. By regulating the initial flow of electricity to the filament, the disc allows the bulb to reach maximum lighting capacity gradually. According to the manufacturer, there is no decrease in light output. Bulb-Miser, which can be used with all incandescent bulbs up to 250 watts, is especially cost effective when used with more expensive incandescent track lighting, spot lighting, and similar incandescent bulbs. Bulb-Miser Corporation of America.
Circle 114 on reader service card

Stack-Parabolic luminaires offer energy-efficient lighting for library stacks and other narrow, vertical areas. They have an open-bottom parabolic reflector that provides precisely controlled narrow beam distribution for even illumination of vertical surfaces from top to bottom. Applications include hallways, electronic switching equipment areas, and computer terminals, where the sharp cut-off provides desktop lighting yet allows maximum screen visibility. Lighting Products, Inc.
Circle 115 on reader service card

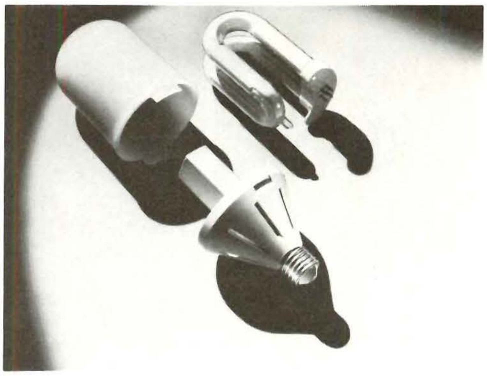
Parabolume 60™ fluorescent lighting fixture consumes less energy than traditional lighting, according to the manufacturer, and is less expensive. The 20 x 60″ fixture, which will hold two or three fluorescent lamps, is designed to replace 20″ x 48″ fixtures to fit into 60-inch ceiling grids. Installation costs are also reduced up to 25 percent. Columbia Lighting, Inc.
Circle 116 on reader service card

A 22-watt fluorescent fixture, Model 892-22, designed to replace an incan-
[*Products continued on page 172*]


Light Diet
A strict regimen of reduced energy consumption, coupled with enhanced visual comfort. An attractive alliance, engineered by Gardco's Focus Ten. H.I.D. sources deliver both reflected ambient and direct lighting (diffused or controlled task beam) from freestanding and ceiling-mounted luminaires. Touches of light from the ring reveal and lower aperture grace the outline of the luminaire. Now quality of light does the work of mere quantity, and curbs the powerful appetite of office lighting. Gardco Lighting, 2661 Alvarado Street, San Leandro, California, 94577. 800/227-0758 (In California 415/357-6900).
Gardco Lighting

Products continued from page 170

descent downlight, fits inside a 6-inch recessed "can" and fastens to the ceiling. The housing is heavy-gauge steel with black polyurethane exterior finish, white reflective interior coating, and acrylic prism diffuser. According to the manufacturer, it casts as much light as a 75-watt incandescent lamp. Moore-Lambert Industries.
Circle 117 on reader service card



The Econ-Nova™ compact fluorescent lighting system for incandescent sockets consists of a base with ballast, a fluorescent tube, and a removable translucent diffuser. It produces light equivalent to that of a 75-watt bulb, says the manufacturer, yet uses only 25 watts—a 66 percent reduction in energy use. Bulb life is 7500 hours. It is a suitable replacement in many residential, industrial, or commercial lamps and fixtures. Westinghouse Electric Corp.
Circle 118 on reader service card

Energy-saving desk, floor, and wall lamps that use 9-watt fluorescent bulbs are said to offer light equivalent to that of a 60-watt incandescent bulb. Reflectors are painted white inside for added light reflection. They rotate 90 degrees to direct light where it is needed. Bulb life is 10,000 hours, reducing maintenance costs. All lamps are solid brass with polished brass or polished chromium finish. Nessen Lamp, Inc.
Circle 119 on reader service card

Task light STC-30, for direct mounting to the underside of cabinets or shelves, uses a 14-watt, white light, U-shaped fluorescent bulb. Two of the fixtures provide more illumination than a 40-watt fluorescent light. An asymmetric reflector directs 70 percent of the illumination directly to the work surface for greater efficiency. Accessories are available to convert the light to a wall-mounted fixture or a desk lamp. Halo Lighting, Div. of McGraw-Edison Co.
Circle 120 on reader service card

Paesar Excess Light Turn-off (ELTO) automatically switches off artificial lights when daylight provides sufficient illumination. ELTO controls incandescent, fluorescent, and HID lighting circuits, switching lights off at a level selected by the user. ELTO will control existing lamps without modifying fixtures. Each unit controls one 20 amp lighting circuit. Lutron Electronics Co.
Circle 121 on reader service card

Lightwatch lighting controls use infrared sensors to detect temperature changes, such as that of the human body, and turn on lights. A time delay allows the lights to remain on for a period of time after the area has been vacated. Exterior control Lightwatch II has an all-weather housing and is available as control only, with one lampholder, or with two lampholders. Indoor control Lightwatch 9 is made in six models with a choice of surveillance patterns. Colorado Electo-Optics, Inc.
Circle 122 on reader service card

The C-10 lighting control system provides custom lighting control in applications from individual rooms to multibuilding systems. It can be used on indoor or outdoor lighting having incandescent, fluorescent, HID, or quartz light sources. Its modular components can be relocated as requirements change. The system operates by means of a wall-mounted or portable desktop control for local lighting or programmable controls and minicomputer for central control of larger installations. RELOC, Lithonia Lighting.
Circle 123 on reader service card
[*Literature continued on page 174*]

Literature continued from page 172

Literature

'Energy Saving Ballast Replacement Guide' lists 6 Mark III ballasts that can replace 142 ballasts from Advance and three other manufacturers. They operate on 120V and 277V models and their cooler operation doubles ballast life expectancy. The guide lists energy-saving benefits and shows annual expected dollar savings. The ballasts meet ANSI specifications for standard lamps and are physically interchangeable with standard ballasts. Advance Transformer.
Circle 208 on reader service card

Conservolite® Daylight Savings System has sensors that detect available light around each fixture and reduce wattage to meet desired light level. Individual adjustments are possible, where additional light is needed, by moving the control. The system requires no computers, special ballasts, additional power source, or extensive rewiring. It is described in a six-page brochure. Conservolite, Inc.
Circle 209 on reader service card

SwitchMate retrofit lighting control for commercial buildings is described in a six-page, full-color brochure. A design diagram is included, along with a complete description of components. The system can control up to 250 areas; individual switches can override the system where light is needed when the system is off. The brochure offers a design guide. Wide-Lite Corp.
Circle 210 on reader service card

'Office Lighting,' a 44-page publication, covers planning, designing, and energy management of lighting systems for office tasks and environments. Intended for use by lighting designers, architects, engineers, and contractors, the publication has been approved by the American National Standards Institute. "Office Lighting," Publication ISBN 0-87995-011-0, is $9 for IES members, $13.50 for nonmembers. Copies can be ordered from The Illuminating Engineering Society of North America, 345 E. 47 St., New York, N.Y. 10017.

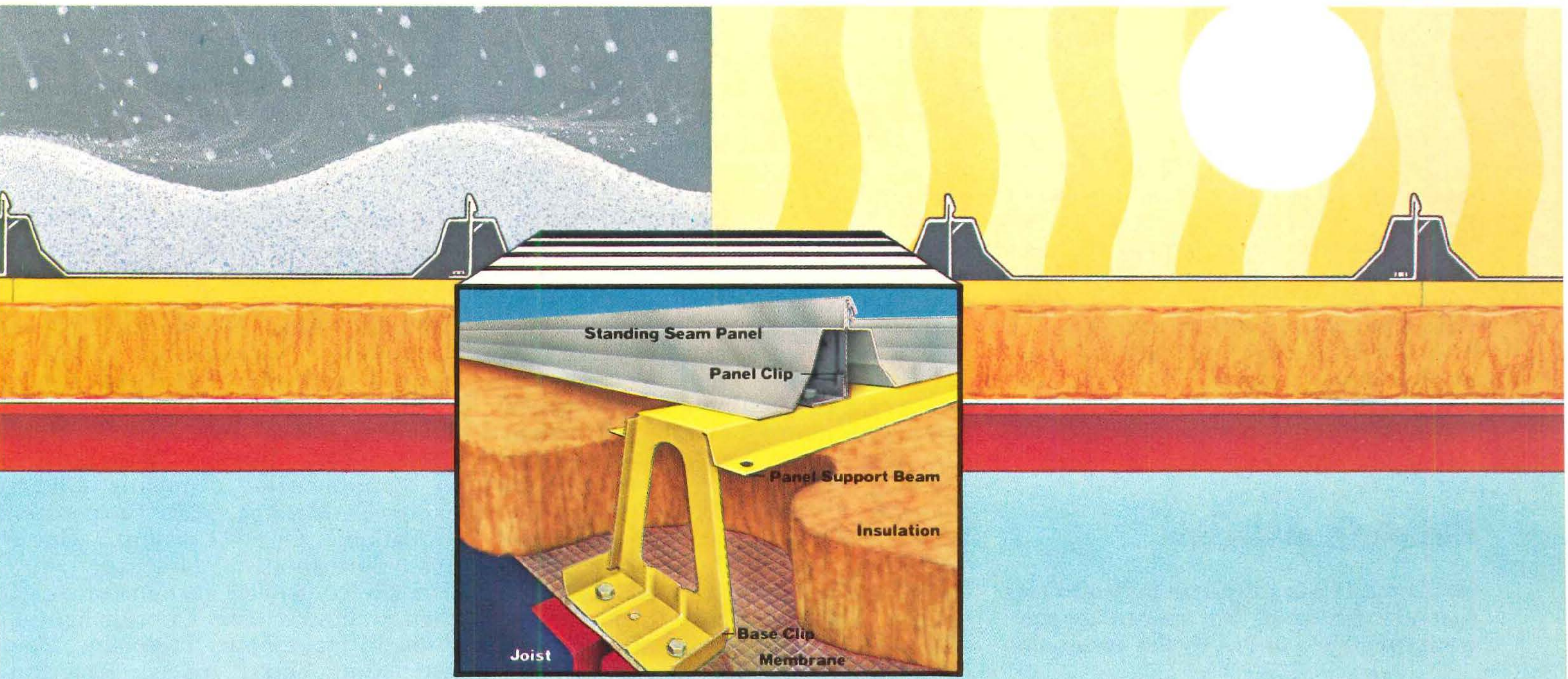
Other energy products

COSS™ control system simplifier offers data transfer in any control system, such as energy management, having sensing and operating devices more than 75 feet from the controller. The system consists of compatible components, each with a specific communications function, that connect a control computer or programmable controller with input-output points of a control system. Instead of being hardwired, units are connected by a single communications cable up to 7000 feet long. It is said to save more than 90 percent of installation cost compared with wires in conduit from the controller to each input-output point, and it offers further savings because the modular system can be changed easily and inexpensively. Other applications include industry automation, building security, and fire safety. Control Junctions.
Circle 124 on reader service card

The Solar Card, a site evaluation tool, is a transparent 8" x 10" flat plastic sheet with the sun's path for each month drawn on it. It is possible to tell by looking through the card whether objects will shade a house at various times of day and days of the year. It can be used for solar water heating, house heating, solar electricity, and summer shading. Cards can be specified for a particular latitude. They can be ordered, at $12.95 each, from Design Works, Inc., P.O. Box 489, North Amherst, Mass. 01059.

'Tyvek' housewrap air infiltration barrier of spunbonded olefin is reported to reduce air exchange rates as much as 35 percent. Tyvek is wrapped around the exterior over sheathing, before windows and siding are added. The material is moisture-vapor permeable, eliminating the danger of in-wall condensation. The average house can be wrapped in about two hours. Tyvek also is suitable for use under stucco. Du Pont Company.
Circle 125 on reader service card
[Products continued on page 176]

Now you can have a standing seam roof and



a superior insulation system.

With the Vulcraft Roof Insulation System (RIS), you can have a metal roof and a solid blanket of insulation. No more thermal "short circuits" caused by compressed insulation at the roof/joist connections.

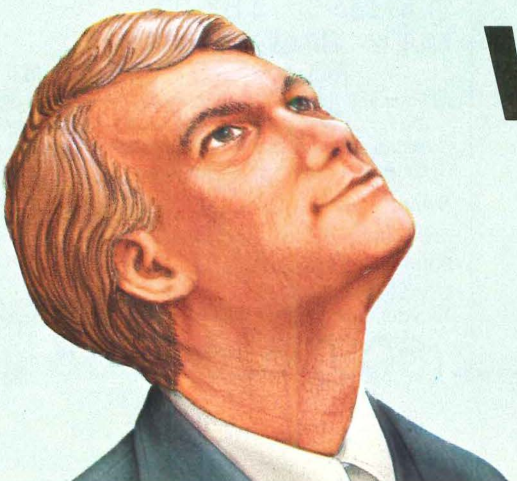
Our standoff system eliminates those thermal inefficiencies and allows for up to 6½" of glass-fiber blanket insulation. Which means you can meet critical thermal demands up to R-20 (U=0.05).

And the supportive interior membrane, erected separately from the insulation, gives a clean interior appearance. It allows use of less expensive, unfaced insulation, prevents unsightly sagging and provides a superior vapor barrier.

The Vulcraft panel support beam then provides the structural base for your standing seam roof.

Keep the Vulcraft Roof Insulation System in mind. Because some day you're going to want a standing seam roof *and* a superior insulation system.

For more information concerning The Vulcraft Roof Insulation System, or a copy of our catalog, contact the nearest Vulcraft plant listed below. Or see Sweet's 7.2/Vu.



VULCRAFT RIS™

A Division of Nucor Corporation

P.O. Box 637, Brigham City, UT 84302 801/734-9433
*P.O. Box 186, Grapeland, TX 75844 713/687-4665
P.O. Box F-2, Florence, SC 29502 803/662-0381
P.O. Box 59, Norfolk, NE 68701 402/371-0020
P.O. Box 169, Fort Payne, AL 35967 205/845-2460
*P.O. Box 1000, St. Joe, IN 46785 219/337-5411

**Roof Insulation System manufacturing locations*

Circle **No. 380** on Reader Service Card

Products continued from page 174

Cyroflex™ double-skinned ¼-inch-thick polycarbonate sheet for greenhouse glazing offers 80 percent light transmission, insulation characteristics, and impact resistance. It has a high strength-to-weight ratio and is flexible enough to be curved easily without heating. Its U-factor is .69 Btu/hour/sq ft/°F. CYRO Industries.
Circle 126 on reader service card

Energy-Kote® radiant heating panels convert electricity into infrared radiant energy to warm room occupants rather than air. According to the manufacturer, they are silent, do not circulate dust, do not affect humidity levels, and require no maintenance. The lightweight panels, ranging in size from 2′ x 4′ to 4′ x 8′, are easy to install and come in all common voltages and wattages. TVI Energy Corp.
Circle 127 on reader service card

Building materials

Major materials suppliers for buildings that are featured this month as they were furnished to P/A by the architects.

Hooker Office Building, Niagara Falls, N.Y. (p. 82). *Architects: Cannon Design, Grand Island, N.Y.* Structural steel: Bethlehem. Metal floor deck: Epic. Glazing: L.O.F. (E-Z Eye and clear). Curtainwall framing and windows (aluminum, baked enamel): Wausau. Insulated metal panels: Alply, The Stolle Corp. Solar shading louvers: Moore Co. Soffits: Dryvit. Entrance doors: Herculite, Blumcraft (swinging); Crane Fullview (revolving). Overhead doors, flush metal: Raynor. Interior doors, flush wood: Algoma Hardwoods. Exterior concrete pavers: Unilock. Interior floors, terrazzo: Brooks. Ceiling system, 30″ x 30″ coffers: Armstrong. EPDM membrane roofing: Carlisle Tire and Rubber Co. Sealants: Sonneborn. Rigid insulation: Styrofoam, Dow Chemical Co. Batt insulation: Owens-Corning Fiberglas. Interior partitions: gypsum board on metal studs. Interior paint, latex primer and alkyd finish coat: Pratt & Lambert. Hinges, ball bearing: Hager. Locksets, key in knob: Sargent. Door closers, overhead: Sargent. Panic exits, orbit knob: Von Duprin. Cypher locks: Continental Instruments. Communications/intercom: Rotellom. Computer room raised floor: Litsky. Building automation system: Johnson Controls. Elevators: Dover Corp. Moving stairs: Otis. Concrete on metal pan stairs: Alp Steel. Lighting: Miller (troffers), Steelcase (indirect HID), Lam (indirect). Electrical poke-thru devices: Dual-Lite. Plumbing fixtures: American-Standard. Showerheads: Power. Flush valves: Sloan. Washroom/bathroom accessories: Parker. Water fountains: Elkay. Sprinklers: Central. HVAC: Tempmaster (coils and VAV), Rite (boiler), Trane (chillers). Carpets: J & J Industries (26.02 nylon).

Conservation Center, Concord, N.H. (p. 86). *Architect: Banwell White & Arnold, Hanover, N.H.* Glue-laminated beams and columns: Unadilla. Wood windows: Pella. Greenhouse skylights: CYRO "Exolite." Wood exterior doors: Entrances. Wood interior doors: Weyerhaeuser. Gypsum board: U.S. Gypsum. Hardware: Sargent. Fluorescent lighting: Lam. Two-quart toilet: Microphor. Boiler: Tasso. Radiation system: Wan-pan. Heat exchanger: Des Champs Labs.

Princeton Professional Park, Princeton, N.J. (p. 94). *Architects: Harrison Fraker, Architects, Princeton, and Short & Ford, Architects, Princeton.* Foundation walls: Conlight block. Wood roof trusses: Compound Technology. Windows: Howard Industries. Skylight glazing: CYRO Industries. Entrance doors: Kawneer Trifab 450. Interior doors: Therma-TRU. Roofing: Moncrief-Lenoir Manufacturing Company, Glidden Chemical Coatings, SCM Corporation. Insulation: Owens-Corning. Gutters and downspouts: Molenco. Automatically controlled curtain for atrium glazing: Simtrac, Inc. Exterior lighting: Hubbell, Holophane, Prescolite, Moldcast, Kim. Sinks, toilets: American-Standard. Rockbed solar fan: Hartzell Fan Co. Motorized dampers: Trol-a-Temp, Troley Corp. Electric heat [*Building materials cont. on page 180*]

The Lock of Gibraltar.

Introducing the Russwin 7000 Series. A landmark advance in protective strength and security.

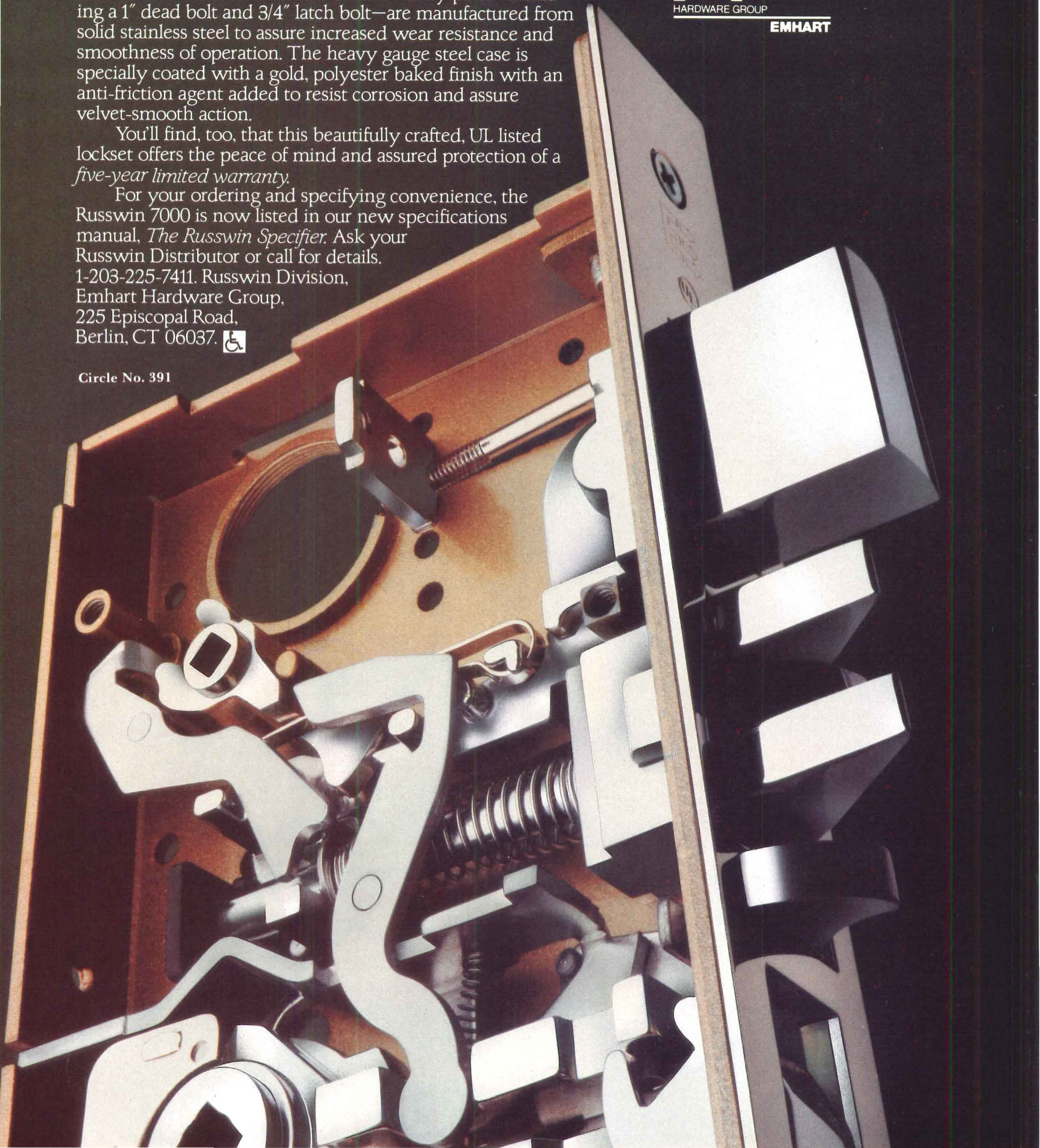
Like the famed island fortress, this new heavy duty mortise lock is made to *endure*. It has absolutely *no equal* in architectural hardware. All stress and security parts—including a 1" dead bolt and 3/4" latch bolt—are manufactured from solid stainless steel to assure increased wear resistance and smoothness of operation. The heavy gauge steel case is specially coated with a gold, polyester baked finish with an anti-friction agent added to resist corrosion and assure velvet-smooth action.

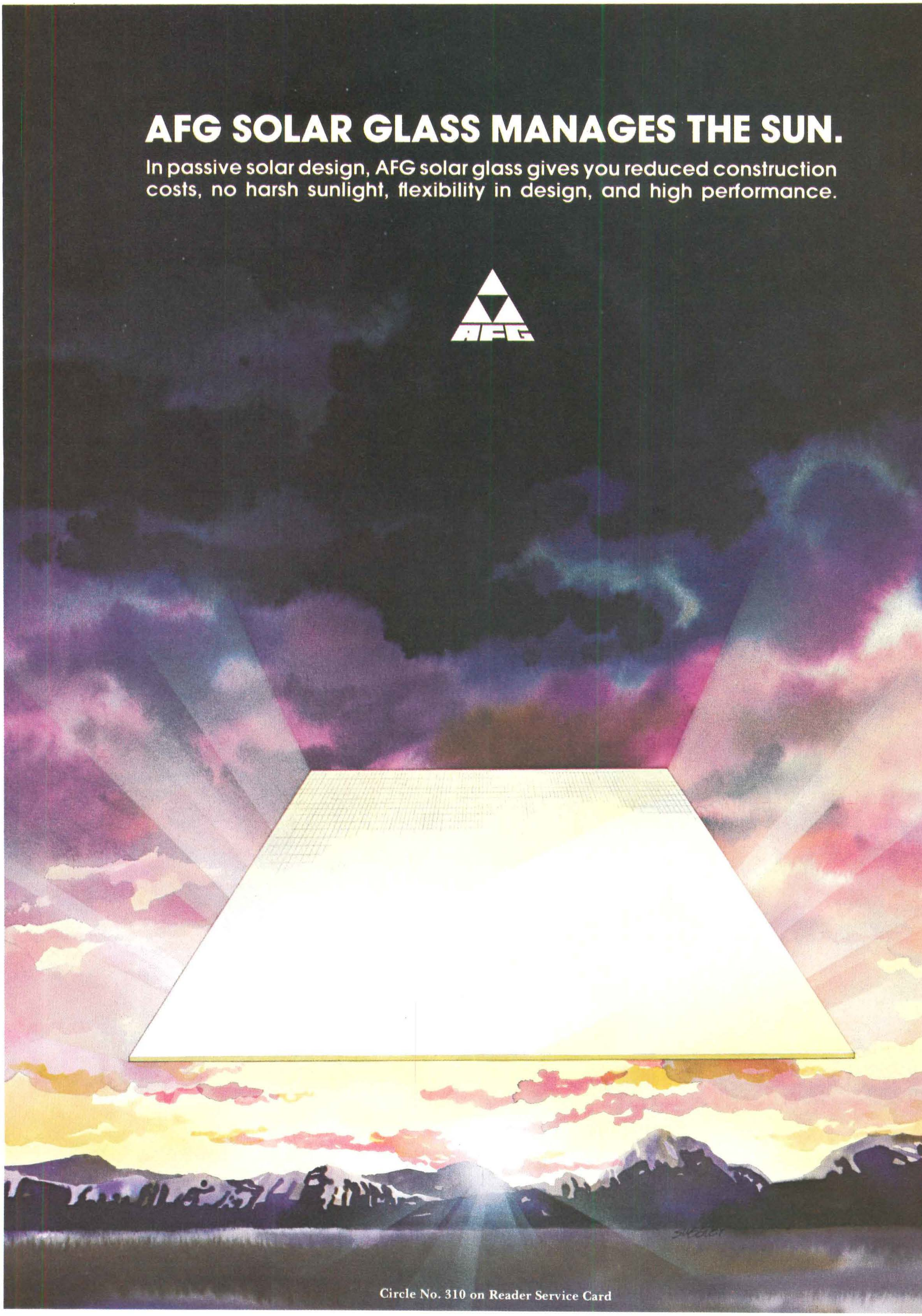
You'll find, too, that this beautifully crafted, UL listed lockset offers the peace of mind and assured protection of a *five-year limited warranty*.

For your ordering and specifying convenience, the Russwin 7000 is now listed in our new specifications manual, *The Russwin Specifier*. Ask your Russwin Distributor or call for details. 1-203-225-7411. Russwin Division, Emhart Hardware Group, 225 Episcopal Road, Berlin, CT 06037.

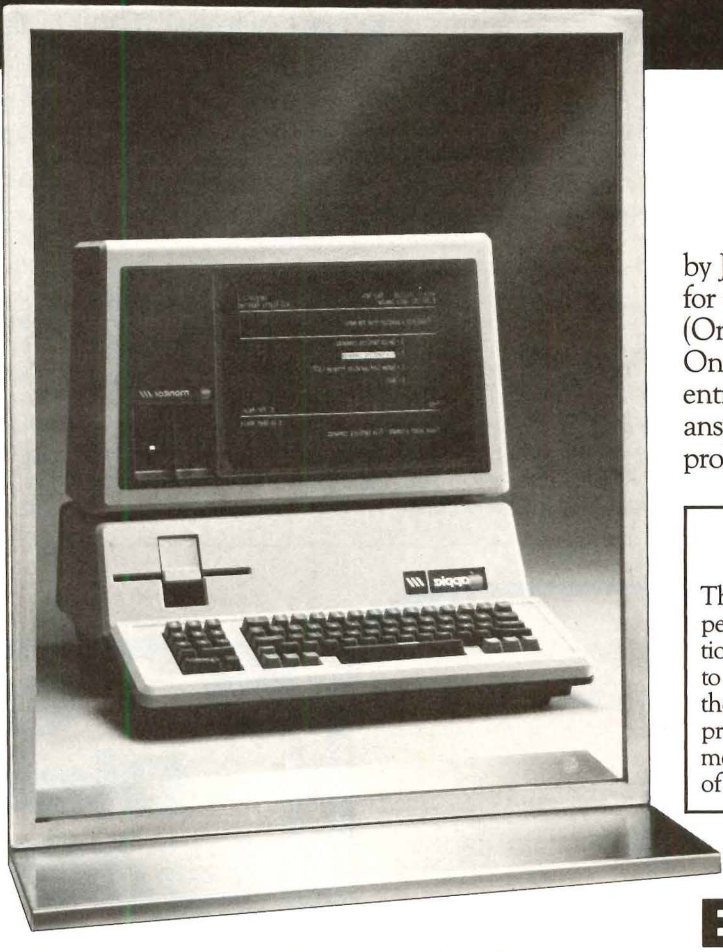
Circle No. 391

RUSSWIN
HARDWARE GROUP
EMHART




AFG SOLAR GLASS MANAGES THE SUN.
In passive solar design, AFG solar glass gives you reduced construction costs, no harsh sunlight, flexibility in design, and high performance.
AFG
Circle No. 310 on Reader Service Card

There's a lot to see in Bradley washroom accessories. Look closely and you could win an Apple /// computer!



Here's a contest that's as easy to enter as it is to specify [B]radley products. It's also the last [“m]ix-up” you'll ever have when [c]hoosing washroom accessories!

With Bradley you can be sure [of] long-lasting, dependable [p]erformance...of washroom [eq]uipment that is not only attractive [b]ut vandal-resistant and easy [to] maintain.

You'll enjoy unscrambling [y]our business and household [p]roblems on your own personal [A]pple computer—it delivers the [sa]me dependable performance you [ge]t from Bradley accessories! To [en]ter, unscramble the names and [se]nd in the entry form today. All [co]rrect forms must be postmarked by June 1, 1983, to be eligible for the drawing on June 30, 1983 (One entry per envelope please. One winner will be drawn from entries submitted with correct answers. Contest is void where prohibited by law.

Win this Apple /// Personal Computer

The Apple /// is an extremely versatile personal computer performing functions from job costing and scheduling to word processing and billing. It's the ideal personal computer for professionals. The Apple /// with monitor has a suggested retail price of $3,244.

Bradley CORPORATION BRADLEY

We get the job done better.

To enter our drawing, unscramble the answers to these questions!

QUESTIONS	ANSWERS	Write your answers here:
1. Whose pre-assembled wash centers get 12 different accessories into a space 17″ wide x 67″ high?	1. BARDLEY	________
2. Who guarantees their mirrors for 15 years against silver spoilage?	2. BELDRAY	________
3. Whose grab bars hold over 1,300 pounds?	3. YELDARB	________
4. Whose hand and hair dryers provide 10,000 hours of maintenance-free service?	4. BERDLAY	________
5. Who offers you hundreds of different washroom accessories?	5. BLYDARE	________
6. Who has more than 200 reps and 70 offices nationwide?	6. DARBYEL	________

Solve the anagrams and return the form to: Bradley, P.O. Box 309, Menomonee Falls, WI 53051.

- ☐ Here are my answers. Please enter them in the Apple computer drawing and send me more information on Bradley's full line of washroom accessories.
- ☐ Please have a Bradley representative contact me.
- ☐ Please send more information on Apple personal computers.

Name ________

Title ________

Company ________

Address ________

City ________ State ____ Zip ____

Telephone ________

Building materials cont. from page 176

pump: Bryant Air-conditioning. Roof spray system: Fanjet Company. Atrium ventilation fan: Penn Ventilator Company. Carpets: Berman.

Trust Pharmacy, Grants, N.M. (p. 109). *Architects: Mazria/Schiff & Associates, Albuquerque, N.M.* Concrete block: Crego Block Co. Wallboard: U.S. Gypsum. Aluminum windows: Alenco. Entry doors: Amarlite. Quarry tile: Color Tile. Asphalt shingles: GAF. Insulation: Owens-Corning Fiberglas. Built-up roof: Goodrich. Shelving: Childs. Wood sealer: Wellborn. Paint: Martin/Senour. Hardware: Sargeant. Signage: Freymiller Signs. Furnace: Carrier. Evaporative cooler: McGraw Edison.

Mt. Airy Public Library, Mt. Airy, N.C. (p. 111). *Architects: Mazria/Schiff & Associates, Inc., Albuquerque, N.M.; J.N. Pease, Associates, Charlotte, N.C.* Cast-in-place concrete: Dixie Concrete Products. Steel joist and metal deck: Oak Burrough Ornamental Steel. Granite: Mt. Airy Granite. Metal-faced plywood panels: Weyerhaeuser. Gypsum wallboard: Shields, Inc. Windows and exterior doors: Kawneer. Hollow metal doors: D&D Specialties. Oak doors: Columbia Lumber. Quarry tile: American-Olean. Wood ceiling: Howard Manufacturing. Single-ply roofing: Carlisle Rubber. Insulation: Owens-Corning Fiberglas, Upjohn. Roof drains: J.R. Smith. Interior paint: Bruning Paint Co. Hinges: McKinney. Locksets and door closers: Russwin. Automatic door holder: Rixson-Firemark. Smoke sensor: Simplex, Inc. Handrails: Oak Burrough Ornamental Steel. Lighting: Moldcast Lighting, H.E. Williams, Lightolier. Lavatories and water closets: American-Standard. Flush valves: Sloan. Water fountains: Halls. Heat pump: Trane. Unit heaters: Markell Heating Systems. Diffuser strip: Titus Mfg. Programmable thermostat: Smart Stat. Solar water heating tank: Ford. Flat plate solar collectors: Sunworks. Carpets: Lees Carpet. Table lamps: Nessen. Task lights: Luxo Lamp. Millwork: Columbia Lumber. Wood bookstacks: Worden Co. Steel bookshelves: International Contract Furnishings, Inc., Vecta Contract Co., Johnson Industries. Reading chairs: Jasper Chair. Stacking chairs: Krueger Seating. Window blinds: Levolor. Book depository: Mosler.

Pajaro Solar Housing, Davis, Calif. (p. 114). *Architect: Sam Davis, Architect, Berkeley, Calif.* Floor joists: Trus Joist. Windows: Blomberg Window Systems. Entrance doors: Pease. Paving stones: Muller Supply Company. Interior paint: Mason Paint Company. Locksets: Kwikset. Gas stoves: O'Keefe & Merritt. Dishwashers: Whirlpool. Fluorescent lighting: Conserv-Energy Products, Inc. Heating system: Trident Energy Systems, Inc. Carpets: Atlas Carpet Mills. Exterior screens: Haluscreen, Selenger Sun Screens.

Department of Justice Building, Sac ramento, Calif. (p. 116). *Architects: Mar quis Associates, San Francisco, Calif.* Co umn forms: Inryco. Waffle pan forms CECO. Metal deck: Robertson. Meta lath: Aqua-K-Lath. Metal panels Robertson Form-A-Wall. Porcelai panels: Ferro-O-Enamel Porcelain Aluminum windows: Kawneer. Sky lights: O'Keeffe's. Aluminum doors Kawneer. Steel doors: Holo-O-Me Wood doors: Algoma. Carpet: Stratton VAT: Kentile. Seamless vinyl: Lonsea Elastomeric concrete coating: Universa Protective Coatings. Ceilings: Arm strong. Roofing and waterproofing Bentonite. Sealants: Tremco. Batt insu lation: Owens-Corning Fiberglas. Roo drains: J.R. Smith. Metal studs: Inryco Gypsum board: Kaiser. Exterior late paint: Glidden. Interior latex pain Fuller. Butt hinges: Stanley. Floo hinges: Dor-O-Matic. Lever sets Schlage. Hydraulic door closers: Read ing. Panic hardware: Von Dupri Intercom: Executone. Raised floo Donn Products. Automatic detectio equipment: Johnson Controls. Signage Ad Art. Elevators: Westinghouse. Stair Pittsburgh-Des Moines. Exterior ligh ing: Gardco. Interior lighting: Sun beam. Underfloor raceway: Robertson Toilet fixtures: Kohler. Fittings: T& Brass. Flush valves: Sloan. Stalls: Globe Accessories: Bobrick. Sprinklers: Cen tral Sprinkler Company. Heating an air conditioning: Trane, Carrier. En vironmental controls: Johnson Control Blinds: Levolor.

Renewable Energy, Renewable Living

The ASES/83 program appears on page 188.

Each year, the American Solar Energy Society's Annual Meeting and Solar Technologies Conference provides the nation's only multidisciplinary forum for discussing the renewable energy field and the future of the quickly evolving energy production sector. This year's conference, to be held from May 30 through June 4, 1983, in Minneapolis, Minn., will bring researchers, professionals, and manufacturers working in the field up to date on technical advances and on the future prospects of technologies in various markets.

The theme of the conference is "Renewable Energy, Renewable Living." It will look at how we can make the transition from a society dependent upon unreliable, depleting energy resources to a society living within its energy means, sustained by a balance between efficient energy use and renewable energy sources. ASES 83 will be more than a solar conference. It will present a national forum on the technological, economic, social, and political strategies necessary to ensure the evolution of a renewable society over the decades to come.

The American Solar Energy Society will offer, at this year's conference, one of the most complete agendas on renewable energy ever assembled. In-depth workshops sponsored by the Minnesota Solar Energy Association will also provide an opportunity for conference participants to hone professional skills in a variety of specific interest areas. Plenary sessions, aimed at drawing the many diverse interests and technologies into a coherent image, will be moderated by futurist Joel Barker. Other nationally prominent speakers are Hazel Henderson, economist and author; Paul Maycock, former director of the U.S. Department of Energy photovoltaic programs; David Morris, director of the Institute for Local Self Reliance; and Vlodimir Jackovlev, with the Organization of American States.

The program

Over 350 papers will be presented at the conference. The papers will address the information needs of those with a professional interest in solar energy research, policy making, design and construction, business, and education. The categories of paper topics include architecture and construction, with a special emphasis on design for northern climates; active and passive solar engineering; agricultural applications; socioeconomics; biotechnology and chemical sciences; physics; and solar radiation.

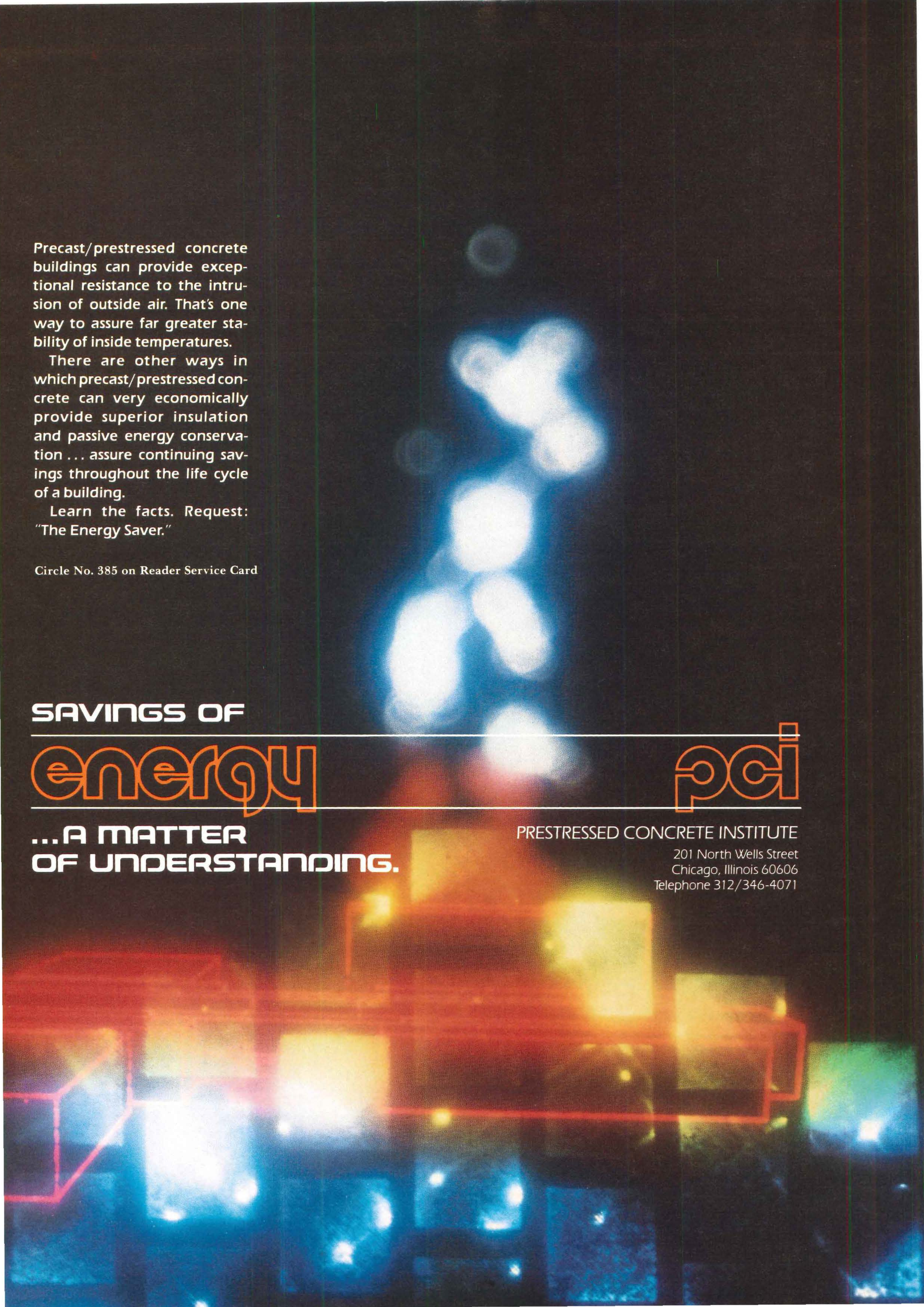
A special feature of this year's conference the Sixth Biennial Wind Conference an Workshop, which is sponsored by the Win Energy Division of ASES and cosponsored b the U.S. Department of Energy's Wind En ergy Technology Division, the American In stitute of Aeronautics and Astronautics, th American Society of Mechanical Engineer Solar Energy Division, the American Win Energy Association, the Electric Power Re search Institute's Advanced Power System Division, and *Alternative Sources of Energ* magazine. The workshop will cover curren research on wind energy going on both her and abroad.

A "Sustainable Communities Design Cha rette," cosponsored by the American Co legiate Schools of Architecture with the Un versity of Minnesota School of Architectu and the ASES Architecture and Constructio Division, is another special event of not Competing student teams from three schoo of architecture will integrate employmen housing, and food production by designing "Sustainable Community of Tomorrow using the Lowertown Redevelopment area Downtown St. Paul as a project site. The d sign charrette will begin May 30 and conclu with a dinner presentation at a joint meeti with the Minnesota AIA Chapter on June

The conference will be complemented an exposition with over 150 displays repr senting the latest renewable energy produc The exhibit will feature a major passive sol products show and a wind pavilion. Oth major areas of emphasis will be solar therm applications and photovoltaics.

Participants will have a wide array of tec nical sessions, interaction sessions, spec events, and workshops from which to choo Interested individuals may register for ha day and full-day workshops on superinsu tion, solar industrial process heat, ener policy, biomass, financing and real estate a praisal, energy-conscious landscaping, eart sheltering, wind, hydro and photovoltai planning and zoning for solar access, sm business management, and microcomput energy analysis. The earth-sheltering wor shop will include tours of representati structures in the Minneapolis area.

The preregistration deadline for the co ference is April 25, 1983. For further inf mation, contact the American Solar Ener Society, 1230 Grandview Avenue, Bould Colo. 80302 (303) 492-6017.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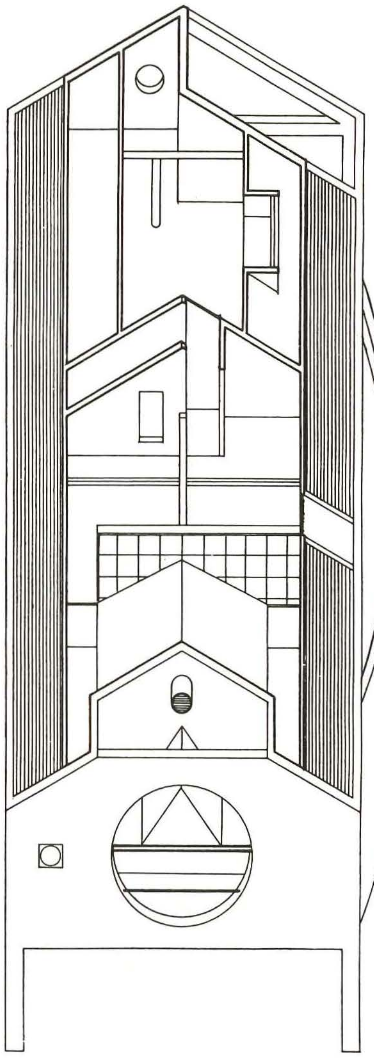

Iouse by Kunihiko Hayakawa.

apanese Architecture will be the subject of n extensive special feature section, with a ritical introduction by Hiroshi Watanabe. Chosen to show the diversity and inventiveness of current work in Japan, the completed buildings featured will range in scale from ome remarkable houses to a bank, two small museums—nothing alike—a corporate training center, to a full-service community center. Diverse as they are, all of the architects involved reflect a heightened respect for the ontexts in which they have built.

The P/A International Furniture Competition will be the subject of a major feature, showing the 16 winning entries, which will be isplayed at NEOCON. Lively jury discussion vill offer insights into the course of furniture esign in relation to architecture.

NEOCON and Systems 83 will be the subjects f two special conference/exposition sections reviewing two events of particular interest o architects and interior designers, taking place in Chicago and Dallas, respectively, in une.

P/A in June will cast an affectionate but critical eye on the new craftsmanship that has become evident recently. Included will be works of architecture in which the materials and onnections are part of the concept, as well as rticles on new craftsmanlike uses of stone, nasonry, metals, and other traditional materials.

P/A in May: Japan/Furniture

ASES 83 Workshops and tours

Below are descriptions of the In-Depth Workshops and Tours that will take place before and after the ASES Annual Meeting.

Workshops

Tuesday, May 31, 8 A.M. to 5 P.M.
Photovoltaics for Designers, Builders, and Other Professionals
Learn the skills and information you need to design and construct photovoltaic residences. Information on the performance of a variety of PV arrays, exclusive marketing information, and forecasts of technical developments will be provided.
Conducted by Paul Maycock, Steve Strong, Dr. John Schaefer, and David Miller for the New Mexico Solar Energy Institute's Southwest Residential Experimental Station.
Fee: $55.

Tuesday, May 31, 9 A.M. to 5 P.M.
Solar Industrial Process Heat Applications
Covers equipment required, needs identification process, required user in-house capabilities, IPH economics, and tax ramifications.
Conducted by Minnesota Department of Energy and Staples and Rochester Area Vocational Technical Institutes (AVTI).
Fee: $55.

Tuesday, May 31, 9 A.M. to 5 P.M.
Solar Greenhouses for the North Country
Presentation will cover both commercial and home-size food-producing greenhouses. Research results from European and North American Universities will be tempered by experience of professional greenhouse operators. For horticulturists, greenhouse growers, builders, designers, and interested homeowners.
Conducted by Jim Wiley, horticultural instructor, Detroit Lakes, Minn. AVTI.
Fee: $55.

Tuesday, May 31, 9 A.M. to 12 M. or 5 P.M.
Energy Action: Legislation and Organization
Morning session covers organizing broad-based support for commercializing renewable energy technologies and design and implementation of legislative campaigns. Optional afternoon session includes lunch and sharing of experiences and ideas.
Conducted by Marcia Janssen, M.J. Associates.
Fee: $30 for A.M. only; add $10 for lunch and afternoon session.

Tuesday, May 31, 9 A.M. to 5 P.M.
Small Business Management
Workshop focuses on management planning for profit and on utilizing function and process analysis as problem-solving tools for management of renewable energy companies.
Conducted by Business Technology Centers of Control Data Corporation.
Fee: $55.

Tuesday, May 31, 1 P.M. to 5 P.M.
Biomass: Potential Resources, Developing Technologies, and Economic Assessment
Focuses on potential biomass resources (cattails, reeds, and short-rotation woody crops) and utilization, equipment, development, and economic assessment for the Upper Midwest region.
Conducted by Dr. Douglas Pratt, Bio-Energy Coordination Office, University of Minnesota.
Fee: $30.

Thursday, June 2, 9 A.M. to 5 P.M.
Financing and Real Estate Appraisal
For lenders, appraisers, inspectors, and real estate agents' brokers. Will cover appraising and evaluating the energy-efficient house. University of Minnesota CEU's available.
Conducted by Minnesota Housing Finance Agency and the University of Minnesota.
Fee: $55.

Saturday, June 4, 9 A.M. to 5 P.M.
Using Micro-computers
A full-day, introductory level coverage of micro-computers that includes a review of general purpose and energy analysis applications. Demonstrations with on-site hardware and sample problem-solving will complete the workshop.
Conducted by Ray Dunn, Energy Systems Group, Inc., Atlanta.
Fee: $55.

Saturday, June 4, 9 A.M. to 5 P.M.
Superinsulation
Learn about successful designs that reduce energy costs through greater use of insulation and control of infiltration and air quality from Minnesota and Saskatchewan researchers. Open to public and professionals.
Conducted by Dr. Dennis Mathiason, Tri-College University, Fargo, N.D.
Fee: $55.

Saturday, June 4, 9 A.M. to 4 P.M.
Alternatives for the Midwest: Wind, Hydro, and Photovoltaics
A workshop for anyone interested in power production using PV, wind, or hydro power (participants will choose their area of inter est). Experts in each field will share practica knowledge. An introduction to small powe production initiates the workshop.
Conducted by Energy Designs: Don Manor Richard Komp, John Gulliver, and Pau Helgeson.
Fee: $55.

Saturday, June 4, 9 A.M. to 12 M.
Earth-Sheltered Buildings—Part 1
A research update on earth sheltering and a discussion of design and construction detail ing with special emphasis on what has and hasn't worked.
Conducted by Dr. Raymond Sterling, Minnesota Underground Space Center.
Fee: $30.

Saturday, June 4, 1 P.M. to 5 P.M.
Earth-Sheltered Buildings—Part II
A traveling seminar, including site visits to large, multistory facilities and residentia structures. Enjoy practical observations and candid discussions with owners and de signers who have worked through planning construction, and occupancy.
Conducted by Kathleen Vadnais, Eartl Shel-TOURS.
Fee: $30.

Saturday, June 4, 9 A.M. to 5 P.M.
Solar Access Workshop
Examine legal rights to sunlight with na tional specialists. Explore legal analyses model ordinances, community case studies and solar design and siting.
Conducted by Solar Access Associates Debra Stangl and Henry Markus.
Fee: $55.

Saturday, June 4, 9 A.M. to 5 P.M.
Landscape Design for Energy Conservatior
The latest in technology and research in energy-conscious landscape design for site planning, structural, topographic, and veg etative mass configurations will be pre sented.
Conducted by Dr. Nicholas Dines (Univer sity of Massachusetts), American Society o Landscape Architects, in cooperation witl the Minnesota Chapter of ASLA.
Fee: $55.

Solar Tours

Tuesday, May 31, and Saturday, June 4, A.M. to 12 M.
Energy-Conscious Design #1
Commercial, Industrial, Institutional
Includes the highly publicized University c Minnesota Underground Bookstore an Civil and Mineral Energy buildings, St. Pa Energy Park, Control Data's famed Worl Distribution Center, and others.
Fee: $15.

Tuesday, May 31, and Saturday, June 4, P.M. to 4 P.M
Energy-Conscious Design #2
Residential
The Skujins residence (reported in Bette Homes & Gardens), the Nelson residenc (heavily monitored), and the Pfister res dence are included, as well as energy efficient and earth-sheltered multifamil projects.
Fee: $15.

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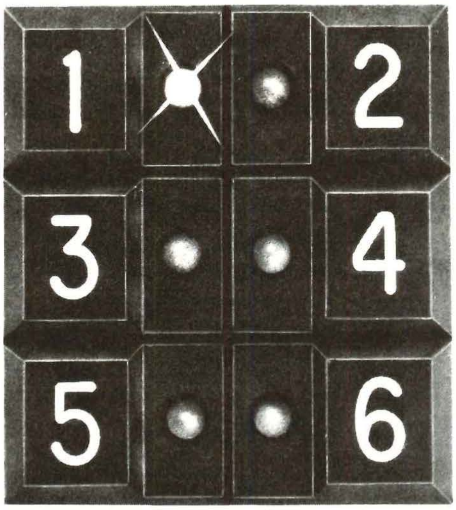

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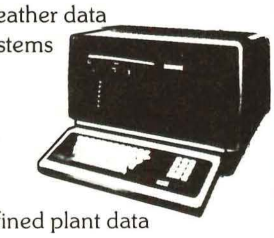

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Developer - One Post Office Square Associates

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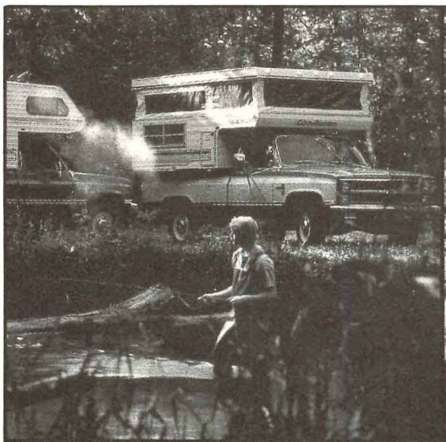
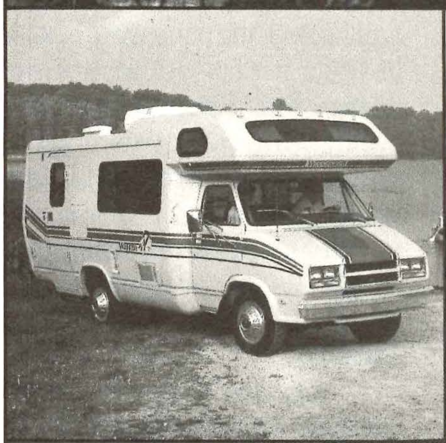
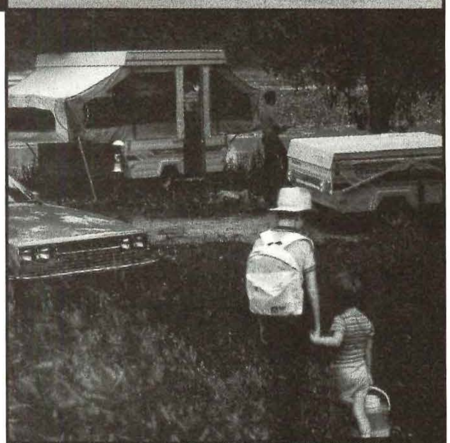
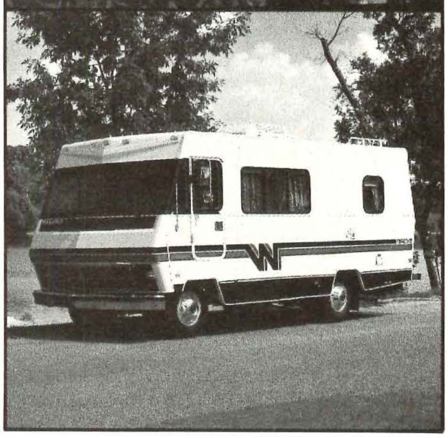


RECREATION VEHICLES: YOU CHOOSE THE STYLE





Among the various types of RVs are (clockwise from lower left) the Phasar motor home from Winnebago Industries Inc.'s Itasca Div.; Winnebago's Warrior mini; a pair of truck campers from Coachmen Industries Inc.; a Royal Coachmen fifth-wheel travel trailer; a Winnebago LeSharo motor home; a Coachmen folding camping trailer; and a Winnebago Brave motor home.

The RV way is an outdoor experience with some or all of the comforts of home. A recreation vehicle can provide temporary living for recreation, camping, touring, or seasonal use. Even the simplest RV offers a place to eat and sleep, while the most elaborate are miniature homes with refrigerators, showers and tubs, and air conditioning. In between there's a wide—and confusing—range of choices.

The top of the scale is the motor home. These 20 to 35 ft land yachts are mostly self-contained—with an independent power source and water and sewerage holding tanks.

The advantages of a motor home are that all facilities are available while en route and there are no parking or trailing problems. But while at a vacation site, mobility is limited

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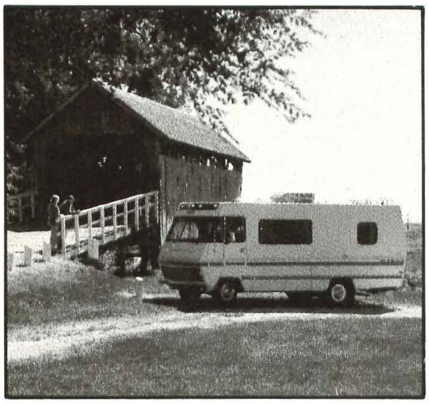
MANAGEMENT PERSONAL TIME

unless the motor home is disconnected from the site systems (RV resorts and campgrounds provide electric, water, and sewerage hookups). Many motor home owners solve this problem with bicycles or motor bikes carried on racks—or tow a compact car for getting about locally.

Next come mini, compact, and low-profile motor homes—although some are not so little. The chopped vans, commonly called mini-motor homes, have many design variations as manufacturers develop ways of adding living quarters to a van chassis. The difference between the mini and the motor home is that the mini begins with a cab and van chassis purchased from an automotive manufacturer, whereas, with a motor home, the RV producer builds on a truck chassis.

In most cases, chopped-van RVs are less expensive to buy and operate than the motor home.

The compact is the smallest motor home, weighing less than 6,500 lb. Both the compact and low-profile models are less than 8 ft in height.



The Suncruiser is one of the motor homes manufactured by Winnebago's Itasca Div.

A van camper, another popular type, is a standard van to which the RV manufacturer has added a raised roof so that a person can stand upright in the living area. Sleeping and kitchen facilities are usually included and a toilet is not uncommon.

A van conversion, on the other hand, begins as a commercial-delivery van. The cab sits almost directly over the engine, and the wide side door provides access to the interior. The addition of bunks or seats, storage cabinets, and an ice chest transforms this versatile vehicle into a comfortable camping vehicle, one which many young families use in conjunction with a tent.

The disadvantage is that there is no headroom for standing, but that is balanced out by the vehicle's ability to be used as a second "car."

Trucks and trailers. Truck campers are mounted on pickup trucks, and can be supported by jacks at the campsite, leaving the truck free for transportation. The truck cab is usually not accessible from the living quarters.

This is a good choice if you already own a pickup truck. However, it is important to determine if the truck can handle the chosen camper. A unit with kitchen facilities and beds can become heavy, especially those with large cab-over areas for sleeping.

Travel trailers are pulled by another vehicle. That brings the disadvantages of trailing and maneuvering the unit, and the living facilities aren't available while driving. (State laws prohibit riding in a trailer while it is in motion.)

The obvious advantage is that once you arrive at your site the tow vehicle can be detached and used for transportation. For this reason, the travel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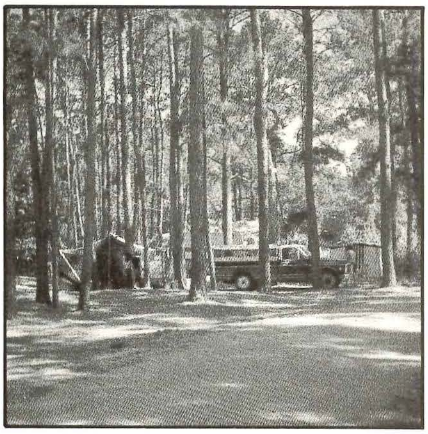

National forest campgrounds generally offer better scenery than private sites, but, in most instances, fall short on facilities.

trailer is often taken to the lake as the family's "summer cottage" or left on-site in Florida or Arizona as a winter home.

Travel trailers come in all sizes from 10 to 35 ft long, and most cars, if the hitch is properly installed, can pull the small trailers (they are now being produced from lightweight materials).

Even the modest travel trailers can have many conveniences, while the larger ones may have almost any feature you'd want.

Some manufacturers offer a telescoping trailer, which lowers to car-top height during travel—eliminating wind drag for better gas mileage.

Similarly, the folding camping trailer, sometimes called a pop-up, has great appeal. It can be pulled by even a compact car. This least expensive of all the RVs folds into a small, low unit for towing and storage, yet when it's in use it opens into spacious quarters. Even basic units have two double bunks and storage cabinets, and most have a stove and icebox or refrigerator. Some also include a toilet and shower.

Specialized units include the fifth-wheel travel trailer and the park trailer—seldom moved though it can be transported without special highway permits.

Expensive? While some of these RVs are costly, there are offsetting savings. The price of a single night for a family in a motel can often pay for a week's campground fees, and one restaurant tab can be triple the cost of a campsite cooked meal.

Gasoline consumption is higher when you're driving or pulling an RV, but manufacturers have trimmed that by using lightweight materials, aerodynamic styling, and efficient engines. Gas guzzlers are as out of style in RVs as they are in cars. And multiple-use vans can serve in gas-saving car-pooling programs.

Other energy is also conserved when a family takes an RV vacation—winter or summer. The house is shut down—with electric and gas consumption at a minimum—while the recreation vehicle uses only a fraction of the energy needed by a conventional house to provide the same living comforts.

One way to try RVs is to rent one. Rental dealers can be found in the Yellow Pages under the headings of "Recreation Vehicles—Renting and Leasing" or "Camper Rentals."

If you decide to buy, conventional RV secured loans can be negotiated for as long as seven or eight years, usually with a 20% to 25% down payment. RVs hold their value well and trade-in allowances are high for units that have been well-maintained.

Where to go? There are literally thousands of resorts and campgrounds, from luxury condominium resorts with saunas, golf courses, and yacht basins to primitive national-forest campgrounds with pine trees and tranquility.

When private enterprise entered the campground business in force some 20 years ago, it took the pressure off the government agencies that had traditionally supplied the nation's campsites. Although public campgrounds, in most instances, have the more scenic locations, the private campgrounds provide better facilities and recreation. In a 1982 survey of users, *Wheelers Guide*, an RV book, found that 44.5% preferred sites that are privately operated, 44.5% liked the private and public parks equally, 7.5% said public campgrounds were their choice, and 3.5% had no opinion.

As there is an RV for every need, so is there a variety of resorts or campgrounds, whether it is a site to lease for the summer or winter, one for a weekend of getaway time, or several located along major routes as overnight stops on a cross-country trip. ■

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Architectural Delineator: National A/E firm seeking Architectural Delineator to prepare site plans, concept floor plans, elevators and perspectives of a quality suitable for publication. Our offices are located in Iowa City, IA, Chicago, IL, and Orlando, FLA. Individuals will be considered for any location, but must be willing to travel as needed on a temporary basis. Will be working with project designers and managers to create desired product. Competitive salary with complete benefit package. Send resume in confidence to: Personnel, Hansen Lind Meyer, P.C., Drawer 310, Plaza Centre One, Iowa City, Iowa 52244. EOE M/F

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Department of Architecture, Ball State University is seeking outstanding candidates for fulltime tenure track and temporary faculty positions in architecture, for undergraduate and graduate programs, effective September 1983. Candidates should be able to teach architectural design and at least in one of the following areas: Structures, History of Architecture Survey, Historic Preservation, Environmental Systems, Graphics, Computer Applications, and Building Technology, as well as actively pursue practice and/or research and scholarly activities. Most appointments will be at the Assistant Professor (or Associate Professor in exceptional circumstances) level. Registration and terminal degree preferred. Rank and salary dependent upon qualifications. Applicants should send letters of inquiry, curriculum vitae, transcripts, and 3 letters of reference. Application deadline: April 30, 1983. Apply to: Professor Marvin Rosenman, Chairman, Department of Architecture, College of Architecture and Planning, Ball State University, Muncie, IN 47306.

Women, Minorities, Handicapped, and Vietnam Veterans are invited to apply. Ball State University practices equal opportunity in education and employment.

Assistant Professor, Department of Architecture, North Dakota State University. 9 month basis beginning September 1983. Teaching architectural design and lectures/seminars in area of interest. First professional degree required; graduate degree desired; office and teaching experience considered. Application, resume and references by May 1, or until position filled: Search Committee, Department of Architecture, North Dakota State University, Fargo, N.D. 58105. NDSU is an Equal Opportunity Employer.

Auburn University's Department of Architecture is seeking applicants for nine-month, faculty positions beginning Fall 1983. The Department offers degrees in architecture, interior design, landscape architecture and community planning. The Department anticipates openings in each professional degree program. Applicants should possess a terminal degree in appropriate discipline and have professional and academic experience. Teaching includes design studio and lecture or seminar in area of applicant's expertise. Salaries are competitive. Forward resume and representative examples of work to: Professor Gaines Blackwell, Chairman, Search Committee, Department of Architecture, Auburn University, Alabama 36849. Auburn University is an Equal Opportunity, Affirmative Action Employer.

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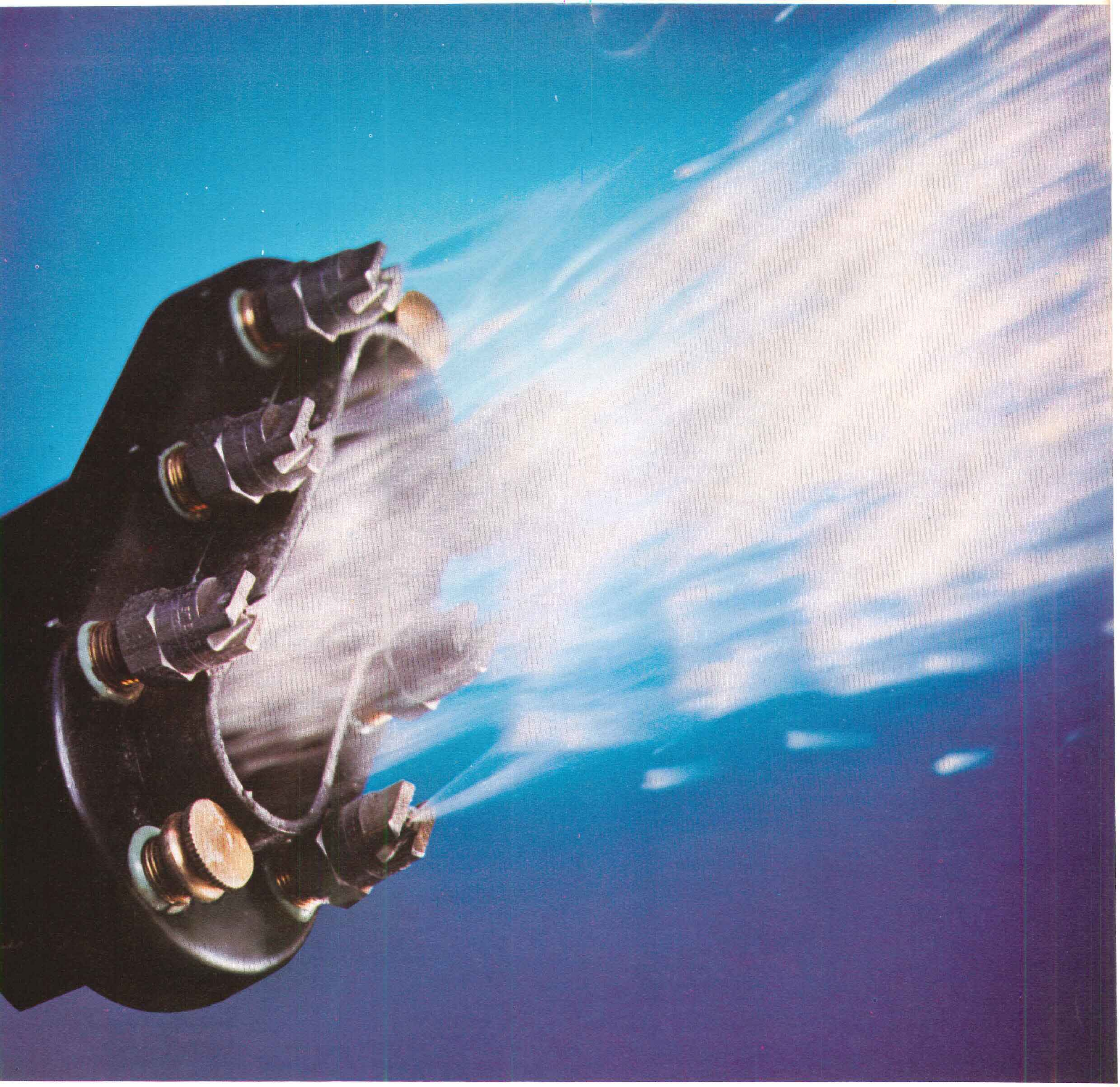

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