ARCHITECTURAL FORUM / JULY-AUGUST 1973

FORUM

ARCHITECTURE AND ENERGY

Aluline. Part of the Straessle Intercollection of Switzerland. Now, all Straessle designs are available in this country exclusively from Thonet. The Aluline program is typical of Straessle's elegant pragmatism. Chairs, 2 and 3 seaters and tables of mirror polished cast aluminum in four basic configurations. Upholstery in your choice of subtly colored glove-soft leathers. At the Thonet Center of Design. New York. Chicago. Los Angeles. Dallas. Write Thonet Industries, Inc., 491 E. Princess St., York, Pa. 17405. Phone (717) 845-6666.

Whitney Publications subsidiary also publishes Industrial Design, Interiors and books in the Whitney Library of Design. Other Billboard publications include Amusement Business, Billboard, Gift & Tableware Reporter, Merchandising Week, Photo Weekly, Vend, American Artist, High Fidelity, Stereo, Modern Photography; Music Week and Record Mirror, London; World Radio-TV Handbook, Copenhagen; Billboard Japan/ Music Labo, Tokyo.

ABP

←On Reader Service Card, Circle 301

THE ARCHITECTURAL FORUM - JULY/AUGUST 1973
VOL. 139, NO. 1 • A BILLBOARD PUBLICATION

4 **LETTERS**

14 **BOOKS**

22 **FACETS**
A monthly review of events and ideas.

36 **FORUM**

38 **ARCHITECTURE AND ENERGY**
By Richard G. Stein

59 **FORUM: ENERGY'S IMPACT ON ARCHITECTURE**
On June 18, 1973 The Whitney Group of Design Publications sponsored this meeting of leading spokesmen in the building industry.

75 **ENERGY INVENTORY**
A selected list of energy research organizations.

76 **BEFORE THE VIRGIN MET THE DYNAMO**
Without advanced technology vernacular architecture has combined native wisdom and resources to achieve adequate light and thermal comfort.

88 **LIGHTING SOME CANDLES**
Answering the energy question will alter the look and outlook of our society.

101 **PRODUCTS**

106 **PRODUCT LITERATURE**

Cover: Steven Lustig

THE ARCHITECTURAL FORUM: Published 10 times a year, combining Jan./Feb. and July/Aug. issues, at 130 E. 59th St., New York, N.Y. 10022, by Whitney Publications, Inc., subsidiary of Billboard Publications, Inc. EDITORIAL & ADVERTISING OFFICES: 130 E. 59th St., New York, N.Y. 10022. Telephone: (212) 764-7300. Sent without charge to architects registered in the U.S. and Canada. Qualified persons are invited to write the Circulation Manager on company letterhead, giving principal state of architectural registration, title and kind of work done. All others: $2 a copy. Yearly subscription price in U.S. and possessions, $14; 2 years, $26; 3 years, $36; Canada, $15 a year; elsewhere, $30. Send subscriptions with payment to: Architectural Forum, Subscription Department, 2160 Paterson Street, Cincinnati, Ohio 45214. Controlled circulation postage paid at Cleveland, Ohio 44114, and New York, N.Y. 10022. **Postmaster, please send 3579 to Whitney Publications, Inc., 2160 Patterson Street, Cincinnati, Ohio 45214.**

OTHER ADVERTISING REPRESENTATIVES: Chicago: 150 N. Wacker Drive, Zip 60606. (312) 644-6763. San Francisco: Cole, Sweeney & Anthony, 85 Post St., 5th Floor, Zip 94104. (415) 397-7279. Los Angeles: Cole, Sweeney & Anthony, 1830 W. 8th St., Zip 90057. (213) 388-0521. Hilton Head Island, S.C.: Paul Yergens, 6 Cedar Waxwing Rd., Zip 29928. (803) 671-2740.

Twindow® insulating glass.

LETTERS

PHILIP JOHNSON

FORUM: Your January-February issue on Philip Johnson deserves congratulations. His work and words show that there is, after all, historical continuity — the need for grace and monumentality in architecture. How wrong are those who insensitively maintain that they are irrelevant, that man has lost his craving for them.

Today's confusion amongst architects and the sheer ugliness of so much work, painfully rationalized into existence is made that much more transparent by Johnson.

Here we have a truly cultured elitist, a great patron of the arts (in the best 18th century sense) who produces unparalleled elegance with verve and sheer technological professionalism. The world needs more like him.

HARRY SEIDLER, LFRAIA
Milsons Point, Australia

FIVE ON FIVE

FORUM: The "Five on Five" article in your May issue is a notable piece of literate and informed journalism.

Architects, like their society, are so much informed by screed and symbol that to come upon a set of handsomely written judgments, balanced between Mr. Robertson's considerate analysis and Mr. Moore's witty commentary, is indeed a signal event, suggesting that we slow down and think, and set in abeyance our perhaps too swiftly formed opinions.

The FORUM, with this article, and the issue on Philip Johnson, bids well to becoming in the seventies what the *Architectural Review* was in the fifties. That is a nice thing to look forward to.

FRANCIS BOOTH, *Architect*
New York, N.Y.

FORUM: Congratulations! It is good to see architectural criticism take its place alongside general reporting in the professional press. Maybe next time architects of the same ilk could critique each other's work —such as Gwathmey criticizing Eisenman or Giurgola criticizing Moore.

MALCOLM HOLZMAN, *Architect*
New York, N.Y.

FORUM: You and the authors of "Five on Five" are to be commended for a fine job of architectural criticism; however, certain issues raised by the book *Five Architects* go undiscussed. This is too bad for these issues are implied by Colin Rowe in his introduction and are precisely the issues one anticipates will be discussed judging from the marvelous titles of each critique. Moore and Greenberg excepted, the authors do not deliver what they promise.

What about all the "Stompin' at the Savoye" we've seen lately? Don't these houses present both an architectural and a cultural phenomenon to be questioned? Explained?

One of the problems of accepting the work of the five architects has to do with the meaning of their forms. If we accept the implicit suggestion that we are in the presence of an architectural revival, it is worth recognizing that these buildings do not and can not have the same meanings as the original International Style. Are these buildings really "Machines in the Garden"? Are steamships and touring cars still machine metaphors in 1973?

Rowe, not Giurgola, points out that cubism has become a part of "The Discreet Charm of the Bourgeoisie." Ignoring the serious intentions of these five architects, aren't they, as Denise Scott Brown would say, ". . . doing styling for a subculture." . . . The fashionable rich? To criticize these houses as idealized and utopian is to attribute to them the original meaning of the International Style. These houses make no claims. They intend no social or formal prototypes. They express the isolation their clients desire by making no gestures toward the rest of the built environment. In this sense Robertson's criticism of Graves' Benacerraf addition, because it does not exist by itself, and Giurgola's appreciation of Meier's housing project in the Bronx seem to the point.

Of the five critics, only Moore seems to appreciate the humor, seriousness, pretentiousness, and perhaps inappropriateness of the publication he is reviewing. Certainly Stern is right, the book is not a major work. However he is wrong to compare it to *Learning from Las Vegas*, for unlike *Las Vegas* it pretends no cultural and perhaps not even a visual polemic. The book is a handsome collection of houses, manifestations of style, taste, and talent, not (Eisenman excepted) new ideas. As Moore points out, the opportunity to see these houses together raises questions. Are they actually related? Are the five architects actually a group?

Surely more could be learned about the five architects and their opposition, "Five on Five", from comparisons beyond the scope of but implied by these reviews. One might compare the weekend house and studio Charles Gwathmey did for his father and the houses done for the Trubek and Wislocki families by Venturi and Rauch. These houses are surprisingly comparable. They are similar in scale and program, calling on and expressing a tradition of wood construction. They exhibit similar notions of controlling a site in relation to the use of architectural volume, and display an obvious interest in historical retrospection. Both are *elitist*. They are talented architectural work, satisfying to their clients, but done for the appreciation of an informed and limited audience. What, if any, are their differences? Will The FORUM offer a forum to explore this question? I sincerely hope so.

STUART E. COHEN, AIA
Chicago, Ill.

FORUM: "Five On Five" reads mainly as an attempt to apply the principles of the hot air balloon to the book review market. That five architects choose to advertise themselves with a modest albeit highly mannered booklet is forgivable—as a private volume for those with the $17.50, who cares!—but, to review such a book *en masse* as though it were a major theoretical treatise with not one but *five simultaneous* reviewers is to impose a burden upon the sensibilities of readers that must be well beyond what anyone can reasonably be expected to bear. Seldom has Architecture implicitly been asked to legitimize such a load of pretentious, self-indulgent journalism. The axiom that the greater the volume of hot air, the higher the balloon will fly does not necessarily become transferable to architectural criticism, i.e., the greater the number of reviewers, the more important the book will become. The resulting effect is surely to discredit whatever modest intentions the five architects may have shared.

The anti-Corbusian brand of avant-garde prescience is at once popular and naive. It is popular because it is easy to view history as a retardant to progress, naive because it cannot deal very well with the fact that the Corbusian dogma has left us with a set of logical principles which, although they may be refuted, cannot conveniently be ignored or discarded. It is paradoxical that our progressive sensibilities tell us that we should be striving for fresh techniques and attitudes to help us deal with current problems, but we are still intimidated by the obvious validity of the Corbusian message; we apparently cannot live with it but it is folly to proceed without it.

But one has the suspicion that the "Five On Five" do not really understand the Corbusian dogma all that well; that Corbusian/cubist propensities are, for them, the function of detail and superficial characteristics: round columns, curved shapes, pipe rails, or just cube-like properties. To accredit "Corbusian genetic inheritance" to the two Steel houses of Gwathmey is curious; what is it in the Corbusian *oeuvre* that they resemble? How the MOMA Harlem project becomes a Ville Radieuse is perplexing; Ville Radieuse used a vocabulary of *zoned* building types—freestanding towers and continuous slab texture—and was detached from existing city texture, while the Harlem project used a vocabulary of *mixed* building types and was inserted into and adapted to existing city texture; ideal city vs. ameliorative city. But they do not even look similar.

How Robert Venturi got into the act at all is a total mystery unless it is as some kind of subliminal catch phrase intended to trigger a set of predetermined reactions. But for those of us who have not been so programmed, what is the comparison? Or, for that matter, what is the difference? Is it all so crystal clear that one really has no need for analysis

(Continued on page 8)

The Duro-Test Watt-Saver.™
90 Watts.
It performs like our 100 watt light bulb.

If you pay the light bill for any kind of commercial or industrial establishment, you know how enormous those bills can be.

And you certainly know that as a country we are now facing a severe energy crisis.

We at Duro-Test are now making a revolutionary new kind of light bulb.

It's called the Watt-Saver.

It saves electricity.

It saves money.

By using Krypton gas, our 90watt Watt-Saver bulbs have the same maximum lumen output and life as our 3500-hour bulbs of 100 watts.

Our Watt-Saver uses 10% less electrical energy.

Our Watt-Saver costs 10% less to light.

A business using 1000 100watt bulbs, and paying the low industrial rate of 2¢/KWH, would save $700 in electricity over the life of our bulbs.

And because they're of premium quality and life, they save on maintenance and replacement costs, too.

To the store owner, the hotel or factory manager, to municipalities, to industrial users—to any small or large user of light bulbs (and sometimes these run into the thousands) the potential for saving money is unlimited. And the potential for saving energy is encouraging.

Your need for light bulbs is unlimited.

Your money and electrical energy are not.

Watt-Savers for residential use are also available in different wattages through Duro-Lite Lamps, Inc.

Call toll free: 800-243-6000 (In Conn.: 1-800-882-6500) for complete literature and ask to see your local Duro-Test Lighting Specialist.

Only Duro-Test makes the WATT-SAVER™
54, 90 and 135 Watts. They Save Power. They Save Money.

DURO TEST

Marketed by DURO-TEST CORPORATION, North Bergen, N.J. 07047. LUXOR LIGHTING PRODUCTS, INC., Empire State Bldg., N.Y. JEWEL ELECTRIC PRODUCTS, INC., Fair Lawn, N.J.
DURO-TEST ELECTRIC LTD., Toronto, Canada 416-661-3344 • DURO-TEST INTERNATIONAL, San Juan, Puerto Rico 722-2950

On Reader Service Card, Circle 305

Standard yet flexible

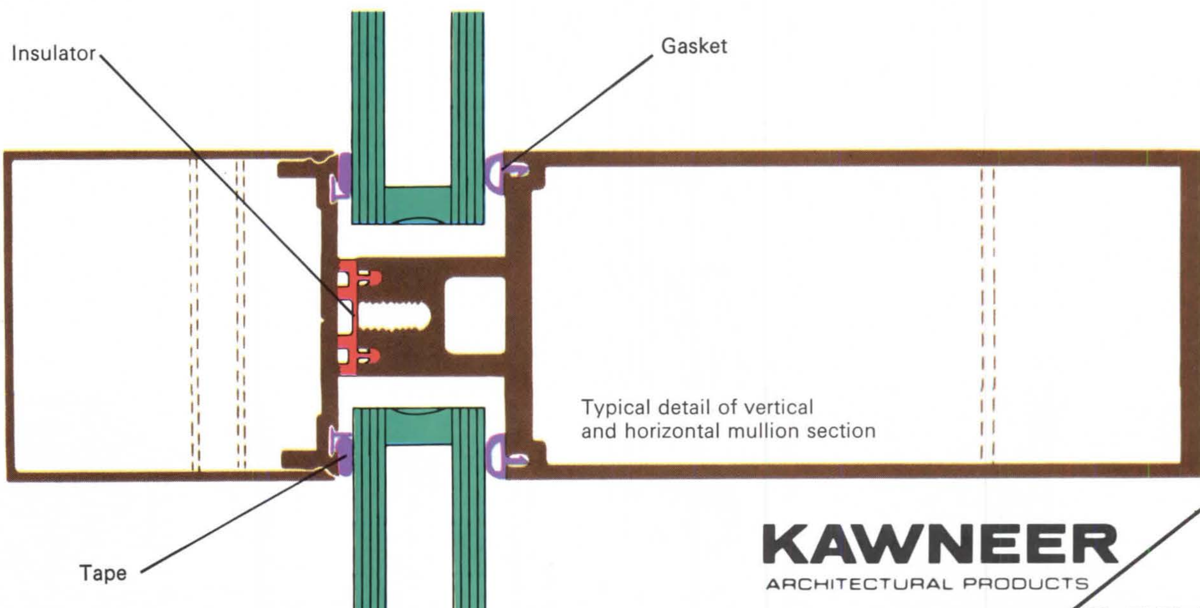
1600 Curtain Wall

for thermal control in the energy decade

Today, and in the years to come, thermal considerations will greatly affect architectural design. Building materials have become an integral part of interior climate systems. Our present energy resources are at stake. □ For complete thermal integrity the designer must look beyond the conventional solutions of thermal and reflective glazing. The aluminum glass holding members themselves can make a vital contribution to thermal efficiency. □ Kawneer pioneered the positive thermal break concept in wall systems. This engineering innovation eliminates contact between inside and outside metal surfaces, completing the thermal barrier of the curtain wall. Heat transfer to the outside in the cold months and into the building in hot months is minimized. Result: expenditures for heating and air conditioning are reduced and energy conserved.

From the design standpoint, 1600 offers the architect a standard thermal system with custom flexibility. A simple modification by Kawneer's design engineering department easily adapted the standard 1600 Curtain Wall System to an application where floors are anchored in place from the top down . . . with the bottom storey 30 feet off the ground. Result for Vancouver's new Westcoast Transmission Building: a "custom" application within standard budget requirements. □ Snap on covers in a variety of durable Permanodic™ finishes allow the architect to create strong verticals . . . shadow box effects . . . or flush facings. □ In 1600 Curtain Wall . . . as in our complete line . . . you can depend on Kawneer engineering. □ Designing for thermal efficiency with attention to detail is Kawneer's pledge for the energy decade.

Architects: Rhone & Iredale, Vancouver, British Columbia

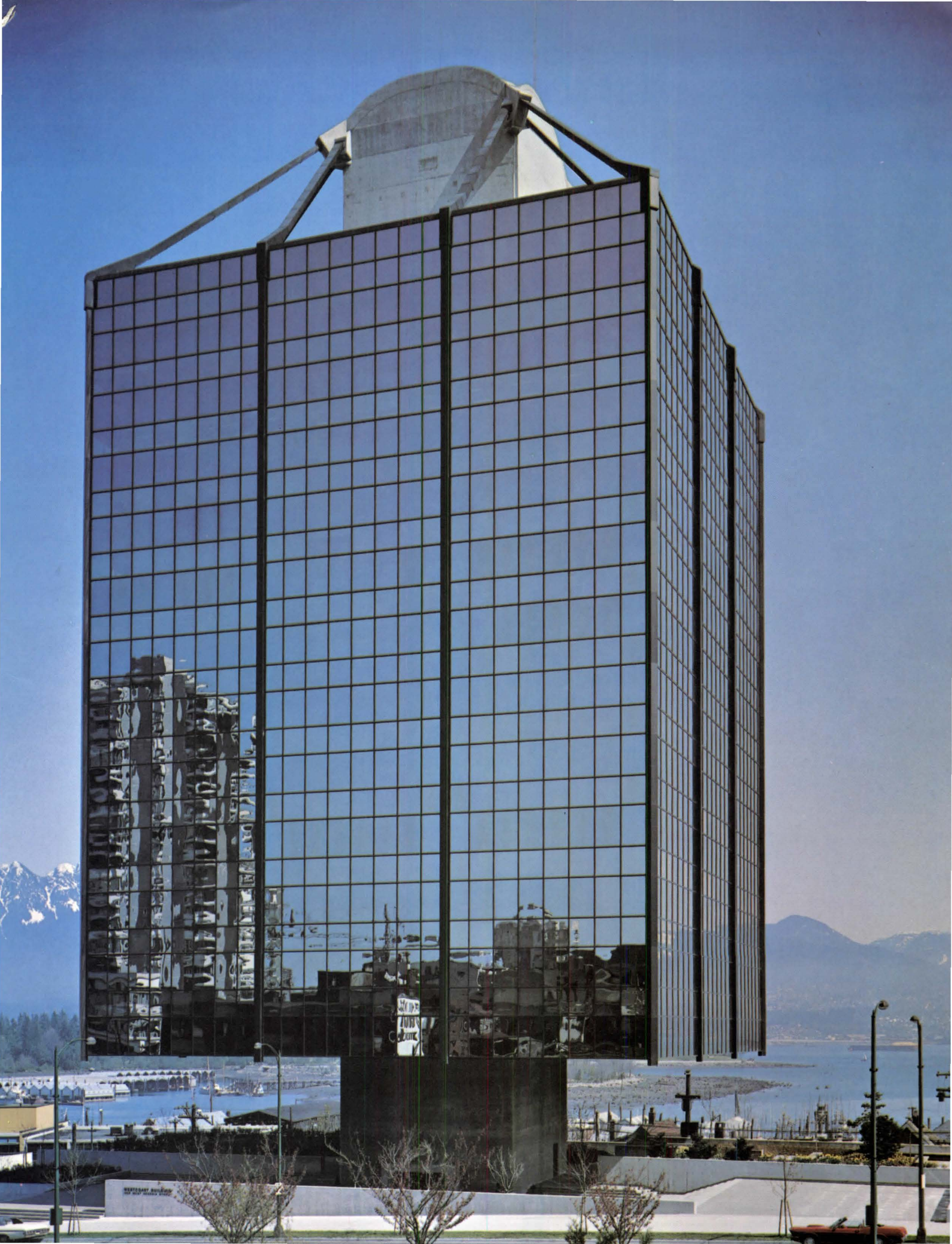


KAWNEER
ARCHITECTURAL PRODUCTS

AMAX
ALUMINUM

For full information, see your Kawneer representative or contact Kawneer Product Information, 1105 N. Front St., Niles, Michigan 49120.

On Readers Service Card, Circle 306



LETTERS

(*Continued from page 4*)

at all? Or, is this supposed to be some kind of plug for The Other Word, or what? Description has largely been substituted for critical analysis and so we hear comparisons to what is known or preferred instead of comparisons which really support a critical point of view: *Five Architects* to *Learning From Las Vegas,* Maison Carrutchet to the Hanselmann addition, Benacerraf to Duke, and, the most empty of all perhaps, Richard Meier's smooth, white, pristine boxes to Andrew Jackson Downing's Shingle Style.

That *Five Architects* is historically derivative is indisputable. It is also probably true that Eisenman suffers somewhat from Terragni overkill, that Graves is trying too hard to turn cubist paintings into buildings, that Hejduk is too abstract, that Meier may have a round column/round corner complex, and that Gwathmey's geometry may be a little scaleless and overpowering. But the problem with the alternative "constructive criticism" is that "sheds" and "ducks" are not terms which are especially loaded with *architectural* content. "Sheds" and "ducks" are implicitly terms which describe how a building is to look *outside,* what kind of billboard, so to speak, it is to be, and the possibility of concepts which foster a dialogue between the inside and the outside as a simultaneous, mutually-reinforcing event is necessarily reduced. "Sheds" and "ducks" do not offer a vocabulary of sufficient dimension to encompass an adequate range of expressions and the essays produced are anemic, architecturally monosyllabic, and too cryptic for all but the most mundane applications.

Whatever the implied polemical assertions, *Five Architects* is trying to deal with the terms of Architecture; with structure, with enclosure, with circulation and functional and spatial hierarchy, with problems of sequence and preferred direction, and so on, and this is not to mutually exclude problems of the user, of complexity and irony, or form and iconography. It is the way of thinking about building *comprehensively* that the five architects share that is important, not their stylistic compatibility, and their work is significant not so much from the forms produced as from the analytical technique applied.

The message then, is not to abandon the "heroic manner" in yet another avant-garde frenzy but rather to adopt it, to modify and transform it, to evolve those principles which are useful in the solution of modern problems. That the results are white, of simple geometry, highly mannered or not "natural", is probably secondary to the basic organizational and formal intent.

Five Architects is also useful as a kind of idea primer. It is neither an essay about how to build nor is it a complete statement about a pure theory. John Hejduk's One-Half House can hardly be taken seriously as a project intended for ultimate construction, yet, at the same time, it is clearly not pure art; it is not definitive. It is what is implied that is important and criticism of the projects per se cannot get at this fact. These projects mostly appear as exaggerations of principle, caricatures of buildings; experimental essays; they are deliberately abstract and detached and seem purposefully estranged from "real" problems; criticism at that level cannot adequately explain their motive. They seek some future less mundane than a simple search for the ordinary.

Journalistic excess notwithstanding, to assume that either *Five Architects* or *Learning From Las Vegas* will become crucial to any future polemic seems doubtful. And, finally, although Robert Stern may not wish to believe it or may not understand it (and one wonders why he chooses to exhibit so much public bad taste as to carry on what can only be thought to be a personal vendetta), Colin Rowe's essay about the Modern Dilemma is perhaps the principal value of *Five Archtects* and will likely become a pivotal literary item in an era rendered difficult by the lack of temporal distance necessary to establish a reasonable historical perspective.

Ithaca, N. Y. ROGER SHERWOOD

FORUM: As regards "Five On Five," it is ironic that the critics who with such clarity and perception can articulate inconsistencies and design weaknesses of another architectural philosophy are yet so unable to see the same bias in their own work. Surely there is little difference in the arbitrary notion of imposing that which is historically trite and perverse into a design and an over reliance upon a 1920's cubism for one's raison d'etre. Although both schools of thought have contributed to the ongoing body of architectural theory, neither points the way for the future. Seeing photos of Meier's and Gwathmey's work once again, however, has its compensations.

ROBERT CURRIE, AIA
Delray Beach, Fla.

FORUM: Having studied briefly under Eisenman, Graves and Frampton, I found your treatment of the Five particularly interesting. They will remember me, if at all, as a particularly unwilling student so galvanized by their work that upon release I scurried into the boondocks to lick and bandage my inclusive, perceptual, vulnerable and pragmatic "Americanism."

Most incomprehensible was, and is, the colossal arrogance—absurdity, actually—of the man/nature relationship implicit in their work and explicit in the tradition which it represents. The very fact of your (welcome) upcoming Energy issue suggests that whatever the benefits of this attitude may be, civilizations with tenure are probably not among them.

A militantly urbane friend once told me that "everything between New York and San Francisco was there to hold the road up." The more people who believe that the better, so far as I'm concerned—but out here we're not about to strip mine one single pronghorn antelope in order to render the glass drawing rooms of the Hampton's habitable.

VINCE LEE, *Architect*
Jackson Hole, Wyo.

FORUM: With reference to the May review of *Five Architects,* I am reminded of medieval theologians arguing about the number of angels who can dance on the head of a pin.

Particularly irritating was Robertson's review which pointed out the lack of concern with real life issues of architecture and then introduced the buzz words of other fields. It's a sad profession that must look to linguistic analysis for an approach to building environments in which people live their everyday lives. If, in fact, these architects do not have the proper tools and anthropological perspective urged by Mr. Robertson on small scale projects, I fail to see how they're equipped to handle the larger project by which, he suggested, they'll be more properly judged.

JULIA THOMAS
Director Communications
William L. Pereira Associates
Los Angeles, Calif.

WTC 2023

FORUM: Your April article on the WTC is the funniest I have ever read in an architectural magazine. I loved it.

New York, N. Y. KURT KARMIN

FORUM: Suzanne Stephens' article on the World Trade Center was absolutely priceless!

ROBERT MUTRUX, *Architect*
Wilton, Conn.

FORUM: Suzanne Stephens' article "WTC 2023" is an interesting glimpse into the history of fifty years ago. It is too bad, therefore, that she puts the reader to so much trouble by citing the long-obsolete British units of measurement, weight, and cubage. Can you advise me where I can find conversion tables at this late date to get their metric equivalents?

WOLFGANG S. HOMBURGER
Institute of Transportation and Traffic Engineering,
University of California
Berkeley, Calif.

FORUM: For a long time I had a basic goal to live to be 85 (yr. 2000). Now you have upped the ante to 108 because on my birthday in that year I want to re-read your plangent article. Marvelous. The architectural profession needs more of such perspicacity.

Phoenix, Ariz. MURRY HARRIS

CHANGING WALLS

FORUM: Your magnificent article, "Changing Walls" (May 1973), is an enlightening presentation of a fast-growing national movement. I would, however, like to point out an oversight. The County of Los Angeles Department of Parks and Recreation, Cultural Arts Section, has sponsored more than twenty murals, which were completed by last summer. Most were located in Mexican-American communities, where their cultural relationship to the Mexican muralist tradition manifested great impact on the community.

For a governmental agency, I believe, we have sponsored more

(*Continued on page 10*)


Wellington
8000 Series
Formal elegance in 3-coat lacquer finish walnut and exacting craftsmanship to bring you the quality you deserve. The graceful, efficient appearance of your outer office and right on through to the executive suite with the WELLINGTON 8000 Series. Choose leather tops if you wish, but choose the finest from JOFCO.
by
jofco
P.O. BOX 71,
JASPER, INDIANA 47546
PERMANENT DISPLAY ROOMS—CHICAGO • FORT WORTH • LOS ANGELES • NEW YORK
WAREHOUSES—DENVER • FORT WORTH • LOS ANGELES • NEW YORK • SAN FRANCISCO • TACOMA

LETTERS

(Continued from page 8)

professionally designed outdoor murals, incorporating youth participation, than any other local or national agency. As a result of our efforts, we have just recently received a National Endowment of the Arts grant to continue the mural movement in Los Angeles County.

I would like, however, to thank you for pointing out to your readers the exciting use of wall murals as an alternative means of rejuvenating grafitti-scarred architectural surfaces.

ED NEISS
Cultural Arts Director
Department of Parks and Recreation
Los Angeles, Calif.

SAN FRANCISCO

FORUM: The April San Francisco issue turned out very well, indeed, and all of us here would like to commend the FORUM staff for the new and interesting direction the magazine has taken.

E. C. BASSETT, AIA
San Francisco, Calif.

FORUM: Many articles are written about San Francisco, and by persons with diverse backgrounds, attitudes, and opinions. William Marlin's is one of the best of the current batch, and in many respects, the absolute best. He reflects the detachment of an outside observer combined with the sympathy and, I suspect, love of a native.

I was Planning Director for nine years (1958-1966) when the pendulum swung from a laissez-faire Board of Supervisors to a tighten-the-planning-screws majority—a period that gave witness to an 11-0 approval of the Embarcadero Freeway monster on the one hand and the freeway revolt on the other. From my witness chair I believe that Mr. Marlin has oversimplified the evolution that has occurred.

Point One: "Some token zoning was passed." San Francisco enacted zoning in 1921 after four years of study and political hassling that was initiated after New York's pioneer step in 1916. In 1947 the Planning Commission, under an aggressive and understanding Mayor, initiated the move to revise and update the zoning regulations. In 1958 when I was appointed Planning Director the sixth draft was curling on the shelf. A new push was initiated to get the measure—rather sophisticated for its time—adopted. The local A.I.A. chapter took a lead role in pushing for the 16:1 FAR in the downtown zone but some members backed off under pressure from clients or potential clients. We compromised on the 20:1 ratio after two years of debate in order to get the 1950ish framework on the books. Then, after some horrible examples cropped up, the Board was pressured—call it "good sense" if you will—into restoring the 16:1 ratio that we had recommended in the first place.

Point Two: "San Francisco didn't have the slightest idea about what an overall planning program was." *Au contraire.* As early as 1940, citizen groups were convening all-day planning conferences, newspapers were carrying special features, and the young professionals, under the name of *Telesis,* prepared a mammoth exhibit at the Museum of Art, depicting the need for comprehensive planning for the city and for the region. As a result, in 1942 the Department of City Planning was established by the Board of Supervisors and the first Planning Director was appointed. In 1946 the Junior Chamber of Commerce spearheaded a move to amend the Charter to strengthen the planning role in local government. World War II had diverted resources and interests, but a Master Plan was adopted in 1945 which set some very important guidelines. From the point of view of the seventies, or of the earlier city beautiful era of Burnham, it had conspicuous deficiencies, but this whole effort should not be glossed over as if it didn't happen. San Francisco has always cared.

Point Three: "A massive zoning revision . . . completed in 1966." The impression gained from your description is that this was city-wide, but, in fact, it covered only Downtown. To be sure, it is Downtown, plus Nob Hill, Russian Hill, Telegraph Hill, and the northern waterfront that convey the popular image of San Francisco, and they constitute the San Francisco that you describe, but these changes pertained to only two square miles.

Point Four: Does Mr. Marlin really think the Bank of America Plaza is "lively"? It has been criticized for being on the north side, and generally in the shade, as well as being windswept. This is true, and hence people don't tarry there. But putting the plaza there was the good-neighborly thing to do in order to preserve the openness and what was left of the scale of Bob Anshen's International Building, already overwhelmed by S.O.M.'s Hartford Building.

Point Five: The Urban Design Plan, initiated by Allan Jacobs, my successor, deserves all the space you give it, for it was the Big Idea whose time had come, and, as you indicate, it helped to save the city from the monotony of a uniform, over-reactive 40-foot (160-foot, downtown) height limit. Its positive concepts will be a long time in implementation insofar as public action is concerned, but that's the other side of the planning coin.

Point Six: Re the Transamerica Building, Mr. Marlin has been influenced by the Allan Jacobs fetish, but many of its detractors are now accepting it as the least of the high-rise evils, and, in fact, one of the most interesting, for at the end of the Columbus Avenue axis, it is really just an exclamation point in contrast to the block-busters behind it. The first rejected design was better, I thought, but, *c'est la vie.* The real issue was faced, or should have been, in the fight for a lower FAR in that transition zone; when that fight was lost —at the Board of Supervisors— the Transamerica or its like was virtually inevitable. Of course, if today's enlightenment had existed fifteen years ago, the legendary old two-story Montgomery Block would still be on that site as a lavishly protected historical landmark. Incidentally, the Transamerica is bringing in 100-foot redwood trees for the plaza on its east side, which was not yet developed at the time of Mr. Marlin's visit. You condemn the Transamerica for being unneighborly and condone the Bank of America because of its plaza. The Bank of America is one of our better designs, but what is most wrong with it, besides its height and bulk which are no longer permitted anywhere under the urban design zoning standards, is its location: it has the effect of moving the top of Nob Hill four blocks east— a visual wrenching of the skyline that can never be overcome. Even Nat Owings has had second thoughts about this, but Donn Emmons, the other responsible character in that scenario, as pictured with your article simply turns his back (literally, his left cheek) on it from his boat in Sausalito—a village, incidentally, that is stuffed with planning and design issues that make it a microcosm of San Francisco and worthy of a story —the FORUM's kind—in itself.

Finally, your photo captions give Larry Halprin all the credit for Market Street, when, conceptually, he deserves the least. This was one of the big issues in my directorship, and Larry then was pushing for an open-ditch mezzanine concept which, fortunately, was warded off. So far as concept and execution are concerned, Mario Ciampi and John Warnecke were in there, with Ciampi in the lead, and unsung bureaucrats like myself were growing ulcers in the declivities.

In sum, Mr. Marlin barely touched the surface of the iceberg, but did it with great spirit and elan. Obviously liking the place, he has left a bit of his heart here as well.

JAMES R. McCARTHY, AIP
Sausalito, Calif.

FORUM: The April issue featuring San Francisco is very fine.

However I do have one question. On page 71 it is stated that there are only 30 women members in the AIA. I doubt this. I do agree that women are under represented in the AIA and probably underpaid in the profession but don't make the numbers worse than they really are.

OLIVE CHADEAYNE, AIA
Walnut Creek, Cal.

The AIA has about 300 women members, not 30. We regret the typographical error.—Ed.

ENCOMIUM

FORUM: By way of expressing my sincere respect for your outstanding achievement, please accept my belated letter. As an instructor of young people who aspire to become architects, I am gratified to be able to cite one professional journal whose excellence is self-evident. I am very grateful and so are my students.

HERMANN G. PUNDT
Professor of Architecture,
University of Washington
Seattle, Wash.

TODAY'S BUI
ARE FACING A NE
LOF GLASS HI

DING OWNERS
W KIND OF CRISIS.
LPS SOLVE IT.

If the movies are any indication, building owners in the 30's had little to worry about except for an occasional visit from wandering gorillas. Today, in some parts of the U.S., there's something tougher to wrestle with . . . an energy shortage. At Libbey-Owens-Ford, we've engineered materials to help ease this shortage.

Vari-Tran® coated reflective glass is being used in buildings around the nation to cut building construction and operating costs. It does this by reducing both the installation and operating cost of air conditioning. Its ability to significantly reduce solar heat gain also reduces the amount of energy needed to cool buildings, which, in turn, helps cool the energy crisis.

For more information on Vari-Tran and other LOF architectural glass, write for our booklet "Reach for a Rainbow," Dept. F-773, Libbey-Owens-Ford Company, Toledo, Ohio 43695.

LOF

BOOKS

RIVERS IN THE CITY. By Roy Mann. Praeger Publishers, New York, N.Y. Illustrated.

REVIEWED BY FRAN P. HOSKEN

"Looking at the plan of New York in an airplane view, you think: 'It is certainly the best organized city in the world.' Well, the sea and the vast rivers are invisible and no one gets the benefit of their beauty, their spaciousness, their movement, the splendid play of light on the water! New York, an immense seaport, is as landlocked as Moscow!"
—Le Corbusier, *When the Cathedrals Were White.*

This statement of Corbusier is quoted in Roy Mann's new book on urban river systems, which analyzes their use (and abuse) and includes proposals as to what we must do to recover this all-important resource.

"The river valley and its branches are the only natural system which still can offer hope of inspiration as well as utility to the urban region of today and tomorrow," Roy Mann told me recently when we talked about the ideas he presents in this beautifully illustrated book.

"In many of our cities we have unfortunately wasted the once-in-a-century opportunity for genuine Renaissance of the river corridor by tearing down old waterfront walls only to let new walls take their place. We have ignored opportunities for total planning of the urban river valley. Any given river site redevelopment project too often only deals with a limited area."

All of us, I am sure, know plenty of examples of such missed opportunities and have deplored the obvious lack of planning and control. But as yet no comprehensive and comparative study of river systems has been made which must precede any organized action. Therefore this book is a most important contribution towards upgrading the quality of life in our urban environment.

Most of our big cities are dependent on and built around rivers and the economic enterprise they support. Urbanists have often wondered why city rivers have seldom been discussed from a comprehensive and regional point of view. Yet rivers literally "make" a city, both visually and economically, and are often the most important recreational resource, not only for the people who live on the river banks, but for everyone who uses a city. A river provides open space, sun and air: Its bank should be designed to be accessible, inviting and to offer breathing space from the confines of the man-made environment.

Rivers in the City takes its examples from a variety of river systems both in the U.S. and abroad, including some of the most famous and historic ones: London and the Thames, Paris and the Seine, the Arno at Florence, the Rhine and Meuse at Rotterdam, the Saone and Rhone at Lyons, and the unique situation of Zurich along its lake with the Limmat and Sihl. (Even today the river and lake water there is so clear that one can swim right in the center of Zurich.)

Venice is also a special case, dependent on waterways that may become its doom. Due to the interference of man, the water level is a steadily rising threat. The northern counterpart of Venice, Amsterdam with the Amstel River and the canals, provides a model of comprehensive environmental control. Carefully organized and coordinated planning is needed to preserve the symbiosis between the water, the urban environment, and the steadily growing number of people who use both. Cars have created an appalling disturbance and discord in this carefully balanced system, as anyone recently visiting Amsterdam can attest. Yet strict planning controls manage to preserve riparian buildings and abundant opportunities for outdoor leisure accompany the tree-lined canals.

The Potomac at Washington provides an excellent case for detailed discussion of the evolution of river-related planning, including the ecological considerations to guide land and water management.

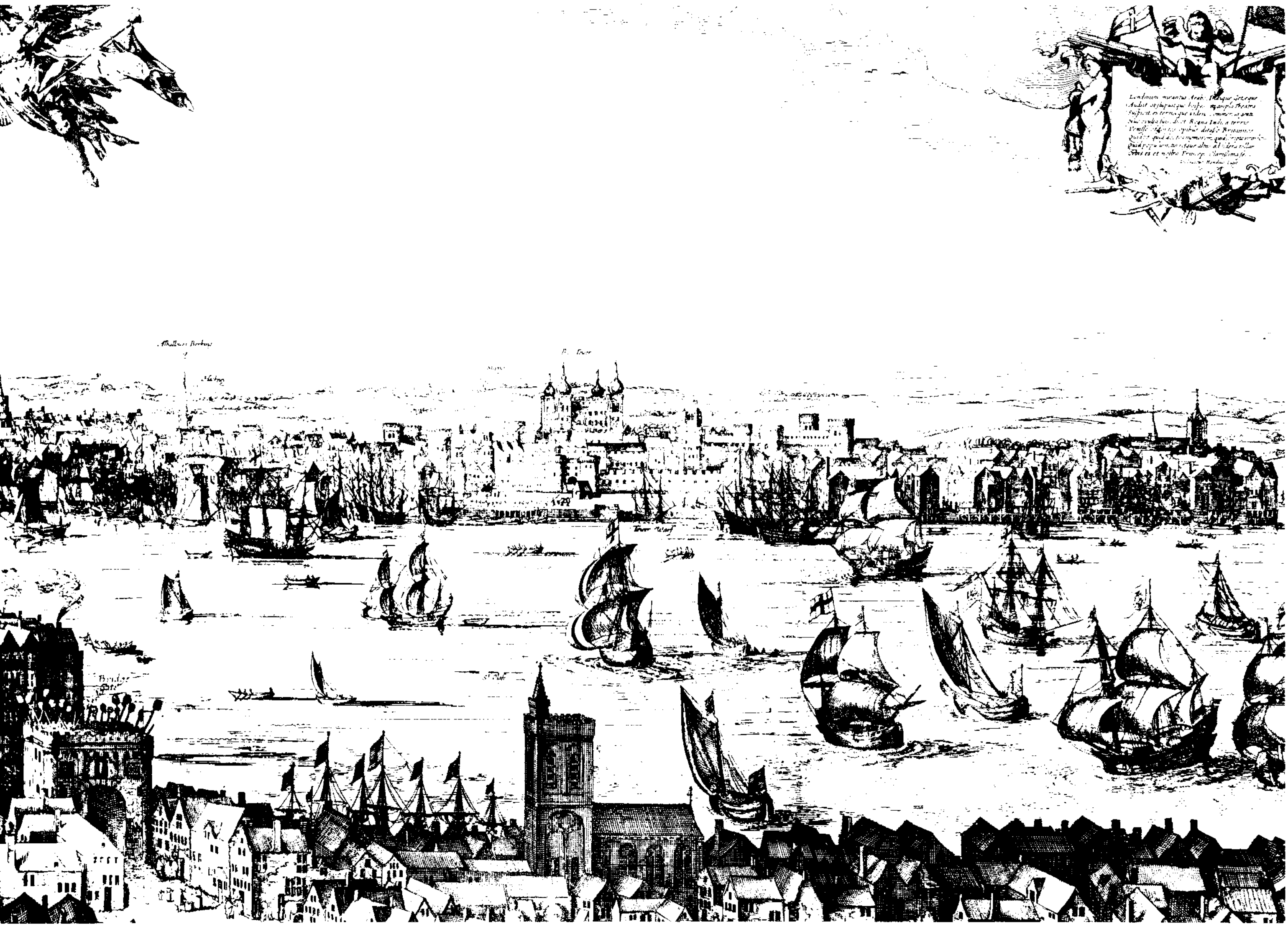
The Charles River in Boston is a sad example of a river gone awry. Despite Olmsted's extraordinarily successful park network, a recently built highway system effectively separates the potential user from the Charles' banks—an example of the latter day redevelopment schemes that Roy Mann deplores. In Boston, as in many other cities, it is clearly a problem of conflicting jurisdictions that makes it impossible to take a regional, comprehensive river valley approach. As Mr. Mann states, "We have to move the walls back and recover the river valleys to provide space for continuous public areas and paths, for new zones of nature in the city and new open areas for public assembly, games and the arts."

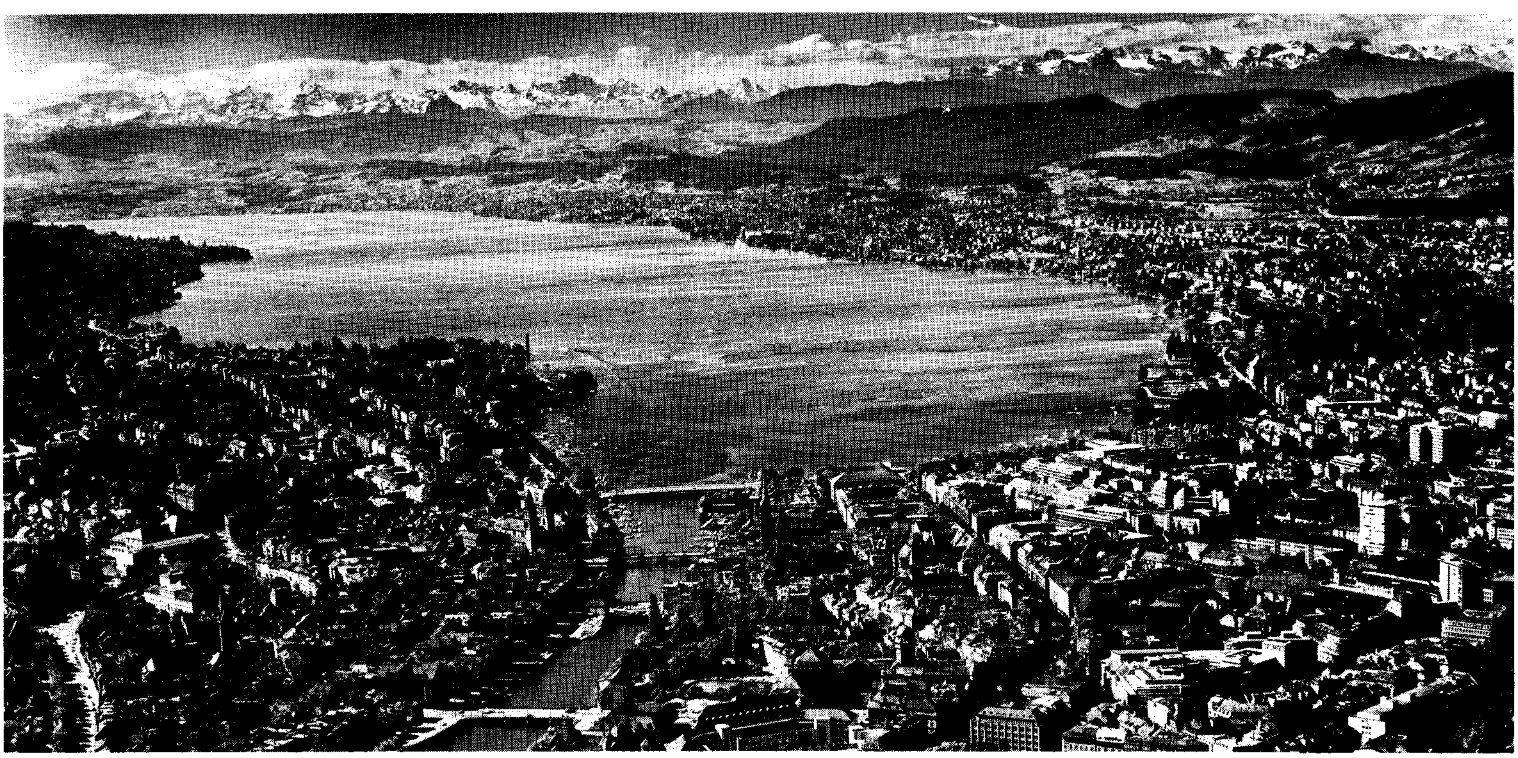
London in the 17th Century.

Altogether, the 15 river systems included in this study show a variety of river valley uses under many very different urban situations—from almost purely industrial ones, as the Tyne and Tyneside, to the opposite in Venice. This is an important book for both architects and planners, written by a practicing landscape architect—the profession that has moved into the forefront of the fight for environmental improvement.

The book, which has just been published in the U.S., first came out in London last April. The Milwaukee Art Center is featuring some photo-murals and material from it in their exhibit on rivers, June through August. In part, the book was supported by a Fulbright grant and should become an important resource for all those working to redeem our natural assets, our rivers.

Ms. Hosken is a Correspondent-at-Large for The FORUM.

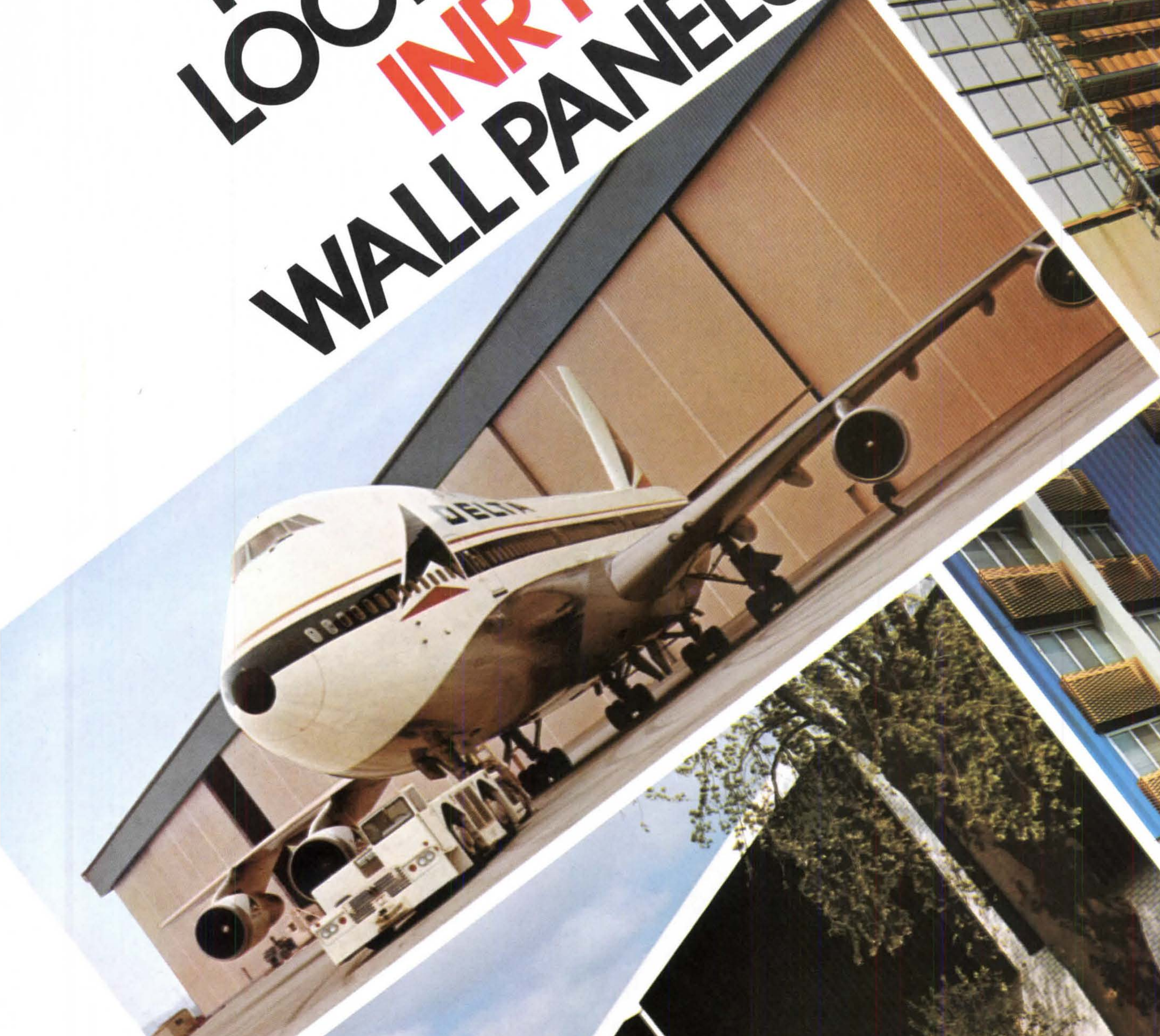




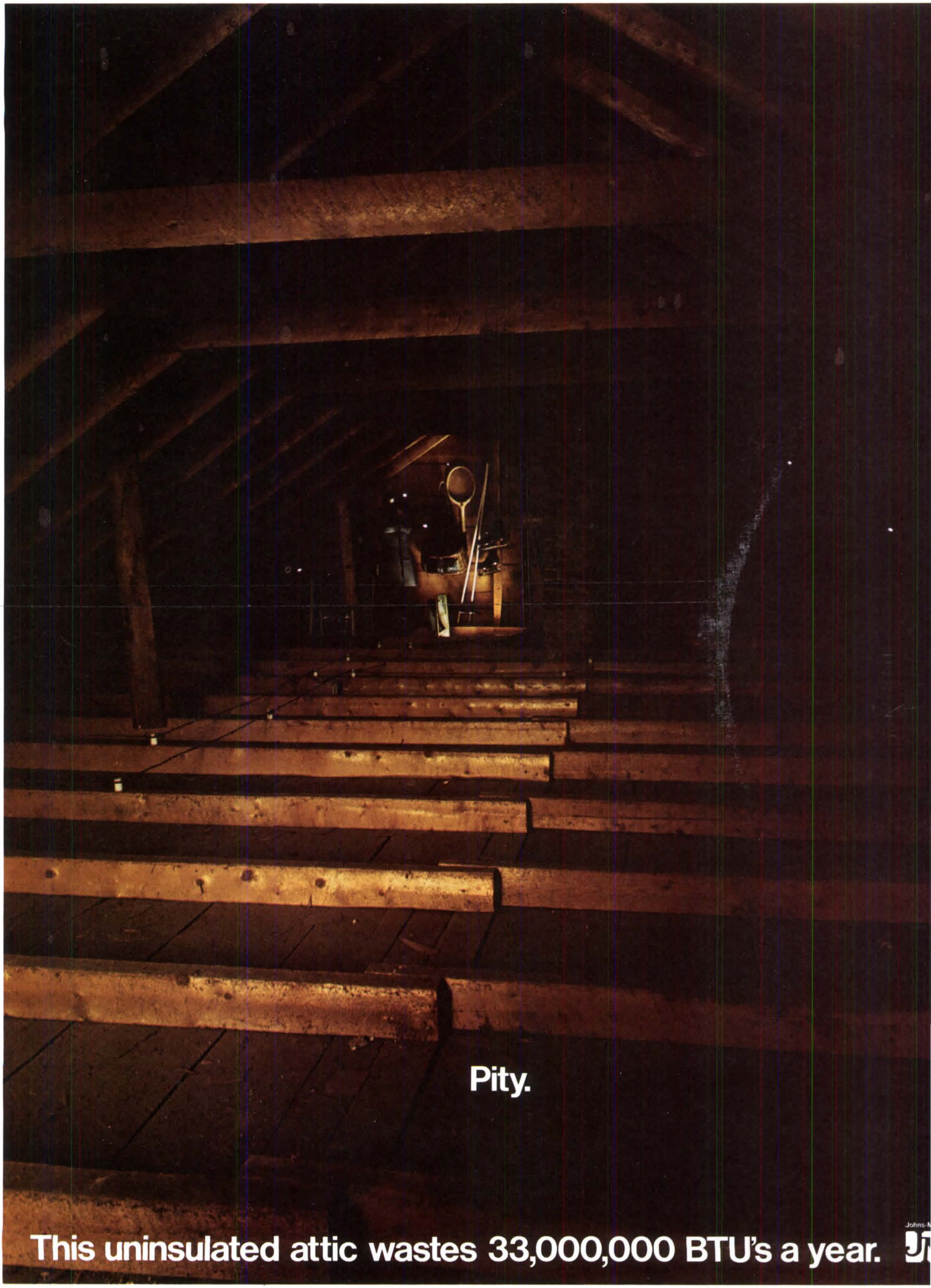
Even today people can swim in Zurich's waterways.

(Continued on page 20)

A NEW LOOK AT INRYCO® WALL PANELS



1. Delta Air Lines, Inc. Maintenance Facility, Atlanta, Ga. Low first cost, fast erection, easy repairability and image-building good looks dictated material selection here. **2. Duane Arnold Energy Center, Iowa Power & Light Co., Cedar Rapids, Iowa.** Inryco Metal Wall Panels need no costly heavy equipment to install, and only light framing. Large pre-fitted panels speed the job and save time on labor. **3. Office/Manufacturing Building, Diversey Chemicals, Des Plaines, Ill.** Inryco Panels were selected for durability, noise control, fire resistance. Installation was fast, economical. **4. Low Income Housing, Kansas City (Kans.) Housing Authority.** Effective insulation, attractiveness and durability were key factors in selection of Inryco Panels for this application. **5. Westinghouse Nuclear Components Plant, Tampa, Fla.** Inryco Wall Panels were chosen to resist high winds, sun-and-salt environment on this huge building. **6. Centralia Plant, Pacific Power & Light Co. and the Washington Water Power Co., Portland, Ore.** Three years passed between installation of first and last wall panels. Yet there was no visible difference in color.


Pity.
This uninsulated attic wastes 33,000,000 BTU's a year.

BOOKS

(Continued from page 15)

UNIVERSITY-COMMUNITY TENSION AND URBAN CAMPUS FORM. Robert L. Carroll, Hayden B. May, and Samuel B. Noe, Jr. University of Cincinnati, Department of Community Planning, October 1972. Volume 1, 115 pages; Volume 2, Various pagings.

REVIEWED BY IRA STEPHEN FINK

Although there are many widely advertised commercial products offering relief from headache and tension, there are no similar products prescribed for tensions created by campus-community interactions. These two volumes of research findings, while descriptive rather than prescriptive, may provide some means for relief because they play down physical form as the major source of such tension.

The goal of the research project, financed by the Educational Facilities Laboratories of the Ford Foundation, was to help universities rationally distribute activities and structures which affect campus-community relations. The authors, all professors at the University of Cincinnati (Carroll in Sociology, May and Noe in Community Planning) focused on the physical and spatial aspects of universities and communities. They acknowledged that many important local and national, social, economic and political dimensions of university-community problems were neglected. Yet it is this limited attempt at a physical/spatial focus which makes the study useful.

Those who study the effects of physical factors will not be surprised by the authors' conclusions: The results repeatedly suggest that people-related, nonphysical factors, rather than purely physical factors, are more significant in creating, or easing, tensions. Thus, while physical determinists suggest that an urban campus be interspersed throughout the community to improve relationships, the process by which campus form is achieved is more important in reducing tensions than the final form itself.

To begin their study, the authors conducted a nationwide survey of 102 college and university administrators. They asked them about their institutions and their surrounding communities, and they reviewed the history of physical campus changes and resulting tensions which occurred in the twenty-year period, 1950 to 1970. Later, they conducted intensive case studies at Boston University, Temple University, and the University of Cincinnati covering the same twenty years.

Although tension and form are never explicitly defined in the study, many characteristics were used to describe form: The size of the institution as measured by enrollment and the amount of land it owns; the degree of concentration or dispersion of the institution in its districts; the pattern and nature of contacts between university and non-university persons; the strength of the university's visual image as distinguished from the image of its surroundings.

Tension is not as succinctly described. In one sense, it is characterized by a strained state of mutual relations. However, at many of the institutions the authors mapped as having frequent or severe tension with their communities, "tension" is really used as a euphemism for civil disturbances, riotous actions, or any community activity leading to the stopping of campus expansion.

Notwithstanding the complexities of the terms form and tension, the authors tested many hypotheses, among which they asked: (1) Was there a correlation between university-community pressures and the size of the metropolitan population; (2) did tension vary with the size of the identifiable population groups in the university districts whose interests were not generally served by the university; and, (3) did it vary with the relative balance of power between the university and these groups?

In testing their hypotheses, the authors concluded that a general milieu of stress pervaded campus communities in large, complex and rapidly changing districts—though, interestingly enough, no correlation was found between community tension and campus size. And no correlation appeared between tension and the percentage of poor or minority group families in university districts (though the method the authors used in aggregating data may mask indications of tension in certain community subareas). The authors were also unable to gauge the effect upon tension caused by the relative balance of power between universities and community groups.

Despite their concern with a negative perspective, that is, for conflict rather than harmony, the authors did find that tensions opened lines of communications which in the long run may benefit both the university and the community. Their contention would be borne out by the constructive solution to "tension problems" at two institutions not the subject of this study—the University of Pittsburgh and Ohio State University. As a result of community opposition to campus expansion in one case, and a riot after a football game in the other, both institutions are now members of umbrella organizations dedicated to joint institutional-community planning.

The results of the authors' more intensive case studies serve to substantiate conclusions derived from their nationwide survey. Although they first felt that the degree of concentration or dispersion of the university and its district was of paramount interest, and the case study institutions were selected on this basis, they ultimately discovered only marginal correlation between form and stress when measured on the "open campus-closed campus" continuum. They concluded: "The dispersion of university buildings in the districts [studied] has nothing to do with university tensions." Agreed.

Some of the conclusions about the three case studies are persuasive simply because of their graphic presentation. In addition to a narrative in Volume 1, the results are displayed in a handsome and useful map series contained loose-leaf in Volume 2. More than one-half of the nearly 100 maps were prepared by computer using a program called SYMAP, which produces contour maps with each progressively higher range of data value shown in a darker tone. With contours based on interpolations between data points located at the center of census tracts, changes in community composition are graphically apparent. Included are separate maps displaying physical, economic, demographic, housing and crime data and changes over the period 1950 to 1970.

Also of particular importance in the study is a section in Volume 1 on self-study methodologies to measure physical development and community relations. The information gathered would be useful in permitting a clearer study of cause-effect relationships surrounding key community events, trends, and controversies in university districts. Further, institutions would be better able to evaluate their own decision processes surrounding these events.

Taken collectively, the survey results, the case studies, the map series, and the methodologies for self-study constitute a useful reference for city planners and architects, campus administrators, and community residents alike. More importantly, this study illustrates the need for institutions to be a good neighbor and employer.

Hopefully, university administrators and campus planners can make immediate use of these studies, and may have particular reason to do so when these efforts are reviewed with other current research activities. For example, in 1971, George Nash, in research sponsored by the Twentieth Century Fund, reported that seventy-three percent of university campuses in central cities with populations of 500,000 or more stated a need for campus expansion. As the authors of this present study indicate, and as a warning to institutions which need to expand, it is the size of the city, the growth rate of the university, and the character and density of the surrounding population which are critical variables in town/university tensions.

As stated, while form-related factors are not always the most critical measures of university-community tension, they are significant. The measures, however, are seldom architectural in *nature*. As the authors reiterate, "the process of physical change and its rate are far more critical than built-form and campus-layout." It appears that these processes, and the patterns and distributions of university-community activities are attributes university planners should control if they wish to influence community relations.

Mr. Fink is the University Community Planner for the Office of the President of the University of California.

St. Benedict Abbey Chapel, Benet Lake, Wisconsin; Architect: Stanley Tigerman, A I A, Chicago, Ill.; Roofer: Antioch Sheet Metal, Antioch, Ill.

TCS...SUPERBLY FUNCTIONAL, AESTHETICALLY PLEASING.

Among the standard architectural metals, TCS (Terne-Coated Stainless Steel) has no equal when measured by the major criteria of durability, corrosion resistance and ease of soldering.

It also weathers naturally to a uniform and attractive dark gray.

On both counts, we believe it deserves your consideration whenever metal roofing or weathersealing is specified.

FOLLANSBEE

FOLLANSBEE STEEL CORPORATION • FOLLANSBEE, WEST VIRGINIA

FACETS

AIA

FUNNY BUSINESS . . .
The annual AIA Convention held in San Francisco (May 7-10) was wracked with few burning issues this year. Resolutions at the meeting were discussed and voted on with record speed and dispatch. Except for one. A resolution brought to the floor by New York Chapter President Tom Galvin and seconded by architect Anna Halpin met with a degree of acrimony, before it was passed. The resolution proposed that the AIA, in an effort to attract and integrate women into the architecture profession, conduct a study on the status of women in the profession, to be presented at next year's AIA Convention in Washington. The resolution itself called attention to the lack of representation of women in the field, the discriminatory hiring policies of architectural firms, unequal advancement and sex stereotyping of jobs. Furthermore, the resolution stated, women are paid less then men for equivalent work, receive smaller salary raises, and are rarely represented among officers and other high level positions in the AIA and comparable societies.

AIA Treasurer Elmer Botsai protested the study idea saying that "under-representation, in all due honesty . . . is not the AIA's responsibility or fault. Discrimination by omission is blatantly not true. From personal knowledge, the Board of Directors of the AIA has gone out of its way to get female representation far beyond their percentage points in AIA activities, and I challenge anyone to refute that statement."


Anna Halpin.

It is interesting to note that the AIA's Board of Directors has one female member in its group of 37. That woman is Fay DeAvignon, President of the Association of Student Chapters of the AIA. In other words, her election by fellow students to that post guaranteed her a position on the Board.

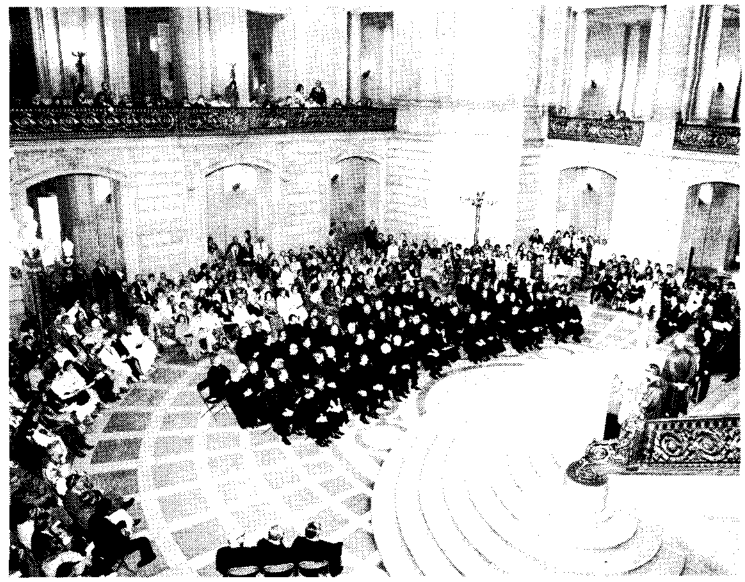
The AIA's interest in women as professionals thus does seem ambivalent (with notable exceptions, such as the New York Chapter where Judith Edelman and Anna Halpin are members of the Executive Committee).

Perhaps under-representation may not be the AIA's *fault*. But lack of representation certainly exists: Of the approximately 36,000 registered architects, about 1,440 are women. Of the AIA's approximately 24,000 members only about 300 are women. In other words the AIA represents about two-thirds of the male architects in the profession, and a little over one-fifth of the female architects. Do women architects feel their contribution is desired by the AIA? Not when its Treasurer feels compelled to announce to the convention's delegates: "Pardon me ladies. This is a sort of motherhood resolution and should not be passed."

Nevertheless it was passed, but by a roll-call vote—the only one of the convention. (A roll-call vote is needed when you can't tell the outcome from aye-nay or show-of-hands vote.) Because the roll-call vote is weighted to states with largest membership, and probably because New York and California supported it, the resolution was passed 996.85 to 627.21.

Meanwhile the regional study groups, which are beginning to meet, have a lot of work ahead of them. Anna Halpin hopes they will include men and women, employees and employers.

NORMAL BUSINESS . . .
Other important resolutions came to the AIA's attention


Fellow's investiture and awards ceremony.

and were passed. One significant one (also proposed by the New York Chapter) concerned energy. The resolution called for the establishment of energy criteria in development decisions, drawing up a report for next year's meeting, and working for passage of legislation to implement energy guidelines. Other resolutions of note included one requesting President Nixon to end the moratorium on housing funding until new solutions are effected, and the freeing of appropriated monies to local governments for sewage treatment facilities and plants.

The speeches by invited panelists echoed many of the concerns expressed in the resolutions. It was refreshing to attend these sessions and hardly hear the word "architect". Instead the conference theme "The Challenge of Growth and Change" was discussed by such outstanding representatives of other disciplines as sociologist Philip Hauser, population expert Dudley Kirk, Congressman (Calif. Dem.) Jerome Walkie, environmental attorney Marvin Durning, Dean of Graduate School of Education at Harvard Paul Ylvisaker, lawyer-developer-urbanologist Bernard Weissbourd, and chemist and former AEC Chairman, Glenn T. Seaborg. Seaborg's comments about energy were optimistic. While he called attention to possible future sources of energy—harnessing heat from the earth's crust or solar radiation to supply energy—Seaborg also professed a belief in the need and likelihood of man being able to do more with less. As he explained: "There are many indications in nature that as an organism becomes more complex, it accomplishes an increasing number of activities with a relatively decreasing amount of energy."

. . . AND PLEASURE
It was difficult for the almost 6,000 architects and spouses who came to San Francisco to really concentrate on business during the three gorgeous May days. Particularly since the convention was held (for the most part) in the windowless bowels of the Civic Center's Brooks Hall. Here in this abysmal environment the exhibits were set up and the seminars—placed not too well acoustically in curtained-off corners of the hall—conducted. The host chapter, however, introduced the very successful and precedent-setting notion of field trips to various parts of the city where solutions to various urban problems had been tried.

Besides trips with groups or privately, there were the parties. Staging parties well often eludes architects for some strange reason, even though it involves familiar design and planning considerations such as tranportation, circulation, logistics and anticipation of users' needs and desires. Specifically, this involves figuring out such details as the time it takes for guests to enter, where people bunch up for food and drink, how to get them to disperse quickly to various parts of the party area. Again in San Francisco this

Host Chapter Party at Oakland Museum.

need for realistic planning was underscored.

One can't mention parties at the Convention without giving credit to the Dodge/Sweet's party. Planned six months in advance, it was not fraught with the troubles common to other convention festivities.

Also the Annual Ball was worth the price of admission if not for the ordinary food or the band (50's kitsch) then for the hilarious toastmaster comments of David Braden, FAIA.

Despite the kinks in some of the planning, San Francisco is an ideal place for this sort of thing, and the spirit of the architects showed it—both on and off the Convention floor.

ARTS

PEI MUSEUM FOR CORNELL

Herbert F. Johnson, a 1922 graduate of Cornell, commissioned Frank Lloyd Wright to design the headquarters of his family's business, The Johnson Wax Co., in Racine, Wisconsin. Wright did a job that brought the company some attention. And in 1967, when Mr. Johnson gave $4.8 million to his alma mater for a new museum there, he asked the committee gathered to select an architect to "find the Frank Lloyd Wright of today."

I. M. Pei's bold design for the Herbert F. Johnson Museum of Art rises six stories above the hills of Ithaca, N. Y. Located at the northwest corner of Cornell's Arts Quadrangle, the heart of the College of Arts and Sciences, the museum contains 20,000 sq. ft. and 20 exhibition galleries, six times the space of the University's recently closed Andrew Dickson White Museum of Art.

The new museum which opened this spring is meant to be more than a place for viewing art. It will serve, for one thing, as a platform for viewing the countryside, and it will also have meeting rooms for trustees and others connected with the University.

Of the entrance, shown here, Ada Louise Huxtable wrote in *The New York Times*, "The only place one feels Mr. Pei's sophisticated mastery of space and light to the full is at the entrance and second levels. . . . The drama is enlivened by calculated light and shade."

The former museum, the White mansion, is being renovated for other uses.

Herbert F. Johnson Museum of Art.

ENVIRONMENT

WRIGHT AND WRONG

When Frank Lloyd Wright chose the desert north of Phoenix for Taliesin West, his aim was to leave the land as he found it. Taliesin, as did most of Wright's buildings, blended with the landscape, demanding nothing of it, taking nothing from it. The desert has not fared so well since.

In 1952 a high voltage transmission line passed within 1,300 ft. of Taliesin West. In 1963 the original line was dismantled and replaced by three new larger, more conspicuous ones.

The desert then was quiet for a decade, except for the hum of the high tension wires. In 1972 the road builders came. A six lane superhighway was needed, they said, and the place to put it was next to the power lines. Working with the City of Scottsdale, the nearest town, which had proposed the highway, Taliesin architects persuaded the town to abandon the project.

But now a threat comes from a more intractable opponent, the U.S. Government. The Bureau of Reclamation plans an 80 ft. wide canal running near the power lines a quarter mile from the Taliesin complex. On its north side will be a 38-ft.-high flood control dike slashing 13 miles through the desert.

Even though Taliesin architects Charles Montooth and Anthony Puttnam have been working with the Bureau, their effects at best will be cosmetic. Perhaps the dike can become curvilinear with varying heights, planted with native vegetation. Perhaps the route of the canal can be broken with lagoons and ponds. But even if these ends are gained, construction of the canal and dike will irreparably scar the terrain. Work is to start in 1974.

As if this weren't enough, plans have been announced for a 124-unit development to the west of the entrance road Wright laid out for Taliesin in the 1930's. Amazingly, nothing has been heard from an oil refinery or a motel chain.

At a moment like this, one would do well to read over Pietro Belluschi's comments early this spring in announcing that Taliesin West had been given the American Institute of Architects' 25 Year Award: "The years have not diminished its elemental quality. More than other works by this master, it shows how to grasp the mood of the land and transform it into a place of harmony and beauty. Here one understands the magic of man's primeval relationship to nature."

You sort of have to wonder what in the world the Bureau of Reclamation is in the business of reclaiming.

THE COLORADO LANDSCAPE

The nine firms competing in the architectural competition for the design of the Johns-Manville world headquarters collected up to $20,000 apiece for their effort. The Architects Collaborative in Cambridge, as everybody must know by now, was the winner and work is going ahead to determine the exact site of the building and its amenities on the 200 acres set aside for them. Johns-Manville owns the remaining 10,000 acres (a former ranch) around what will become the HQ site. According to W. R. Goodwin, President of Johns-Manville, the ranch will remain undisturbed.

TAC is understandably concerned with the effect the 476,000 sq. ft. building, parking for 1,700 cars, greenhouse, roads and utility lines will have on the site, and the firm is recommending that a program of raw water management be undertaken along with construction. Water is scarce in the area anyway, and since construction will lead to increased runoff, the runoff can be controlled and used for landscaping, pools, fire protection, irrigation, air conditioning and even feeding cattle.

Part of the parking (700 cars) will be on the roof of the headquarters building. 1,000 more parking spaces will be on banked, terraced decks sculpted into the hill behind the building. Helices seen at either end of the structure lead to the roof parking area.

Because of the heat and sun glare on the elevated site, preliminary design plans suggest bands of insulating glass (sheathed in a polished aluminum insulated skin) be extended across the facades facing the valley. Moreover, these glass areas will be recessed and shielded by vertical sun screens.

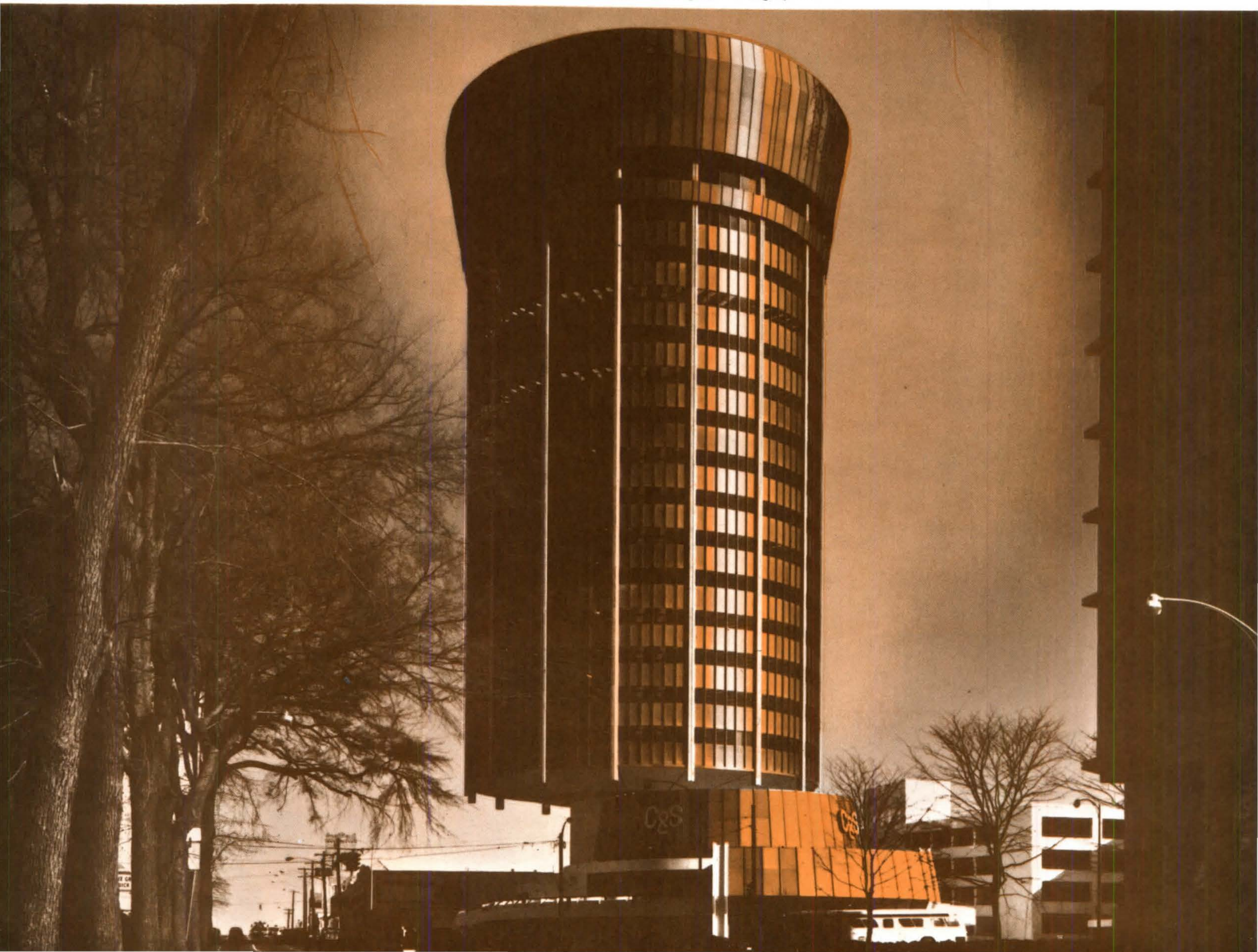
But what impressed the jury most about the TAC approach

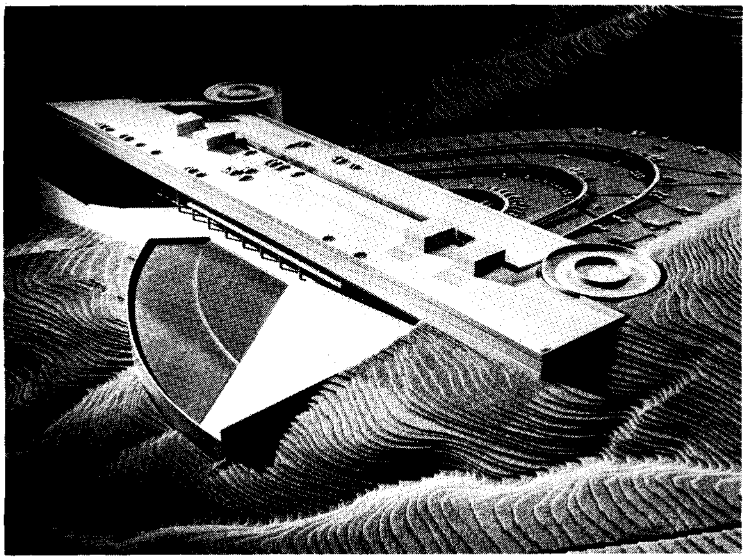
Atlanta's C & S Bank protects money. All-weather Crete insulates the bank and the money.

When it comes to roof deck protection, Atlanta's C & S Bank has it! All-weather Crete insulation. The insulating dry fill that's compacted in place. No seams. Just one monolithic blanket that's sloped to the drains providing thermal protection as well as positive water drainage. All-weather Crete, applied by licensed applicators, is one of those unique building materials that provides the architect with an outstanding, trouble-free roof deck insulation, the contractor with a fast job (no curing with All-weather Crete), and the owner with a maintenance-free roof deck that protects and saves fuel costs year after year after year. Get the facts — see why most of this nation's outstanding architectural achievements utilize All-weather Crete for roof deck and plaza insulation. Contact Silbrico Corporation, 6300 River Road, Hodgkins, Illinois 60525, (312) 735-3322, or see Sweets for the address of your local applicator.

SILBRICO CORPORATION

C & S Bank, Atlanta • Aeck Associates, Inc., Architects • Alexandre Georges, Photographer





Johns-Manville headquarters.

was the concern for and the advantage taken of the stunning natural site. Workers in the building will look out across the valley to the snowcapped mountains to the north. Regarding the entries in general, the jury said: "Given a landscape this remarkable, it is probably not surprising that the most important element in the jury's judgment involved the use of the site. A competitor's philosophy and response to nature and his feeling for the setting was clearly evident in his solution. His attitudes toward access, parking, and siting of structures had to be the prime determinants in establishing his concept. Few seemed successful in this respect, demonstrating that urban architects given a natural setting of this scope and dimension can experience difficulty with the quintessential problem of the man-made environment meeting nature. This being the crux of the matter, one scheme is clearly outstanding."

Total cost for building and site preparation is expected to be about $24 million.

Jurors for the AIA sponsored competition were: Theodore C. Bernardi, architect; Robert L. Geddes, architect; W. R. Goodwin, president, Johns-Manville; Hubertus J. Mittmann, landscape architect; Harry M. Weese, architect; and John B. Rogers, professional advisor. The nine architectural firms participating in the competition were: Welton Becket and Associates, Chicago; Caudill Rowlett Scott, Inc., Houston; Vincent G. Kling & Partners, Philadelphia; Neuhaus Taylor, Houston; I. M. Pei & Partners, New York; William L. Pereira Associates, Los Angeles; RTKL, Inc., Baltimore; Sert, Jackson and Associates Inc., Cambridge; and TAC, Cambridge. To a sublime group, our congratulations. But to TAC, especially—our respects. If architecture is to be led out of the wilderness, the hinterlands of Denver is a good place to start.

LANDMARKS

MORE SPACE FOR THE FRICK?

The Frick Collection is probably one of the finest small museums in the world, and it has a grand building, designed in 1914 by Carrere & Hastings as a residence for Henry Clay Frick, then renovated to become a museum by John Russell Pope in 1935. It stands behind a formal garden on New York's Fifth Avenue, and the tranquility (some might say blandness) of its facade belies the current turmoil within.

Widener House.

A small museum is an anachronism and the pressures on the Frick are enormous. "The museum was designed in the days when we expected 50 visitors a day," Edgar Munhall, joint acting director of the museum explained recently. "Now we get 1,700 visitors a day and we need cloakrooms, lounges and services areas for them." With this in mind the Frick in 1972, purchased the Louis XV style townhouse next door at 5 East 70th Street. Earlier, in 1946, the museum had purchased and demolished the building at 7 East 70th, and earlier still in 1940, it bought and razed the house at 9 East 70th. These adjustments took place before New York had a landmarks law. When the museum bought the Widener house at 5 East 70th from the estate of the late George D. Widener, a Philadelphia trolley car heir, it was with the idea of building a new museum wing on the sites of 5, 7 and 9. This wing would include offices, an auditorium, conservation and photography facilities and the enlarged public facilities. The idea is still valid but under the landmarks law the route is no longer direct.

Although the Widener house (designed by Warren and Wetmore in 1911) was not a designated landmark the Frick building was, and the landmarks Commission requested the museum apply for a "certificate of appropriateness" showing that the facade of the museum wing exposed by the demolition of the Widener house would be in keeping with a landmark. In June the Frick unveiled sketches by Innocenti & Webel, who designed the Frick's Fifth Avenue garden. The plan calls for a fence along the street similar to the one in front and trellises, poplar trees and rose bushes around the other three sides of the garden. The landmarks Commission was pleased and demolition will go ahead at a cost of $200,000.

EXHIBITS

IT'S ALL IN THE FAMILY

An architectural exhibit is tricky. Since there are so few, the selected content becomes critical, particularly considering that these exhibitions reach a public not exposed to other architectural media. The Museum of Modern Art's exhibit, "Another Chance for Housing: Low-Rise Alternatives," demonstrates the pitfalls of an exhibition when a museum ignores its larger public responsibility.

Not that any one can fault the honorable intentions of a show. It demonstrates to the public and governing officials that people can be housed in four-story buildings at a density of 240 persons per acre. (The density in high-rise districts of Manhattan is estimated to be somewhere between 400-450 persons per acre.)

The amenities and built-in security, the community spirit and sense of propriety that such a solution affords have been well documented in sociological studies.

The show is comprised of two projects intended to be built under the aegis of the New York State Urban Development Corporation. Of the two specific applications, one for the Brownsville section in Brooklyn comprises 626 low and moderate income dwelling units sited on 12.5 acres of a 57-block renewal area; the other has 324 dwelling units on 9.8 acres called Fox Hill in Staten Island. At present, Brownsville is under construction; Fox Hill, however, has not yet been approved. Both were designed by the Institute for Architecture and Urban Studies, and represent specific applications resulting from a prototype study made by the Institute in collaboration with and funded by the UDC.

Also on view is the prototype project that resulted from the "Low-Rise High Density Study" the UDC and IAUS undertook. Featured in the four-story structure are private entrances for half the apartments, public entrances serving only several apartments and duplex layouts with gardens or terraces. The architects involved in the prototype study were Kenneth Frampton and Peter Wolf of IAUS, Theodore Liebman, Anthony

(Continued on page 27)

Save up to 70% in space!

Save up to 70% in space!

Joy axial fans offer you this big design advantage over conventional centrifugals of equal performance.

Joy believes air moving systems should be built in, not built around. And the Joy Axivane® fan makes a "built in" system possible. Constructed around the motor, the Axivane fan features in-duct mounting to eliminate duct turns, offsets and plenum boxes.

Result: Smaller equipment rooms. More usable space!

In addition to saving up to 70% in space, the Axivane fan offers these additional benefits:

UP TO 50% LESS WEIGHT
permits reduced structural requirements.

LOWER INSTALLATION COSTS
thanks to a pre-adjusted, self-contained package delivered in one piece for easy, fast installation.

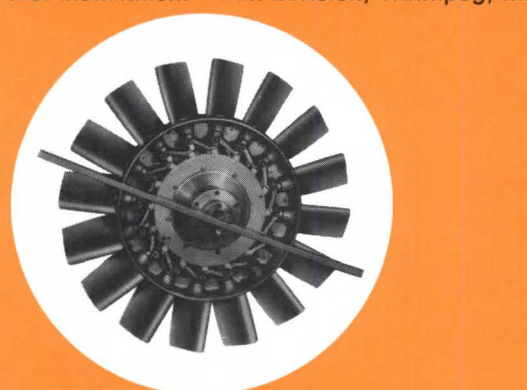
QUIET OPERATION
sound attenuation is much simpler with the higher frequencies of the Axivane fan.

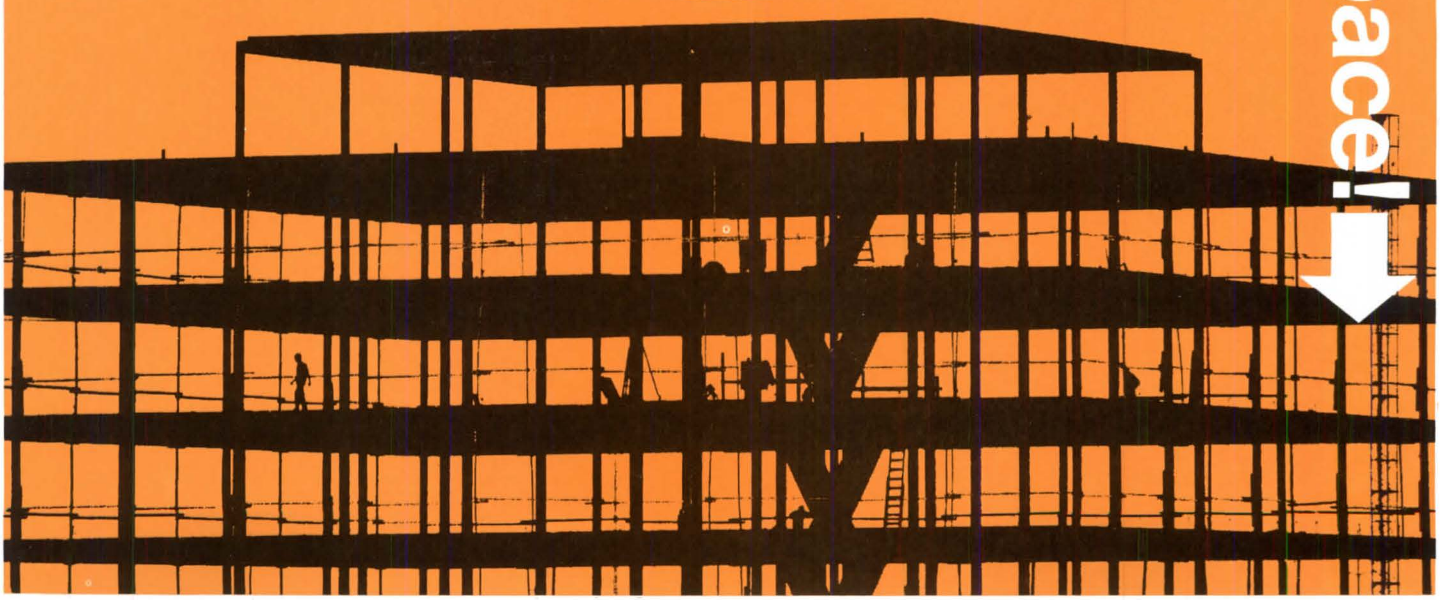
LOWER OPERATING COSTS
due to greater operating efficiencies.

ADJUSTABLE BLADES
provide a wide operating range.

CONTROLLABLE PITCH IN VAV SYSTEMS
for maximum energy savings automatically thru blade pitch control at partial loads.

Yes, you'll have room to spare when you specify Joy Axivane fans. For additional information, contact Joy Manufacturing Company, Air Moving Products, New Philadelphia, Ohio 44663. In Canada: Joy Manufacturing Company Ltd., Alpha Fan Division, Winnipeg, Manitoba.





Offices and plants throughout the world

NEW PHILADELPHIA DIVISION

JOY

On Reader Service Card, Circle 314

FACETS

(Continued from page 25)

Pangaro and J. Michael Kirkland of the UDC. The Brownsville scheme was designed by Arthur Baker (IAUS), Frampton and Wolf; Fox Hills was designed by Baker, Peter Eisenman (director of IAUS) and Wolf. David Todd and Associates are associated on the Brooklyn scheme.

In the Brownsville project, moderate and low-income people (the UDC was able to obtain some remaining 236 monies) will be housed in zero- to five-bedroom duplexes and flats. The mix is distributed so that the majority of apartments have two and three bedrooms, an obvious necessity in attaining the 240 person per acre density the project boasts. The larger apartments—three to five bedrooms—are duplexes with private gardens or balconies. But 378 of the total 626 units are zero- to two-bedroom units without gardens, terraces, or multi-level plans. (They are floor-through, however.)

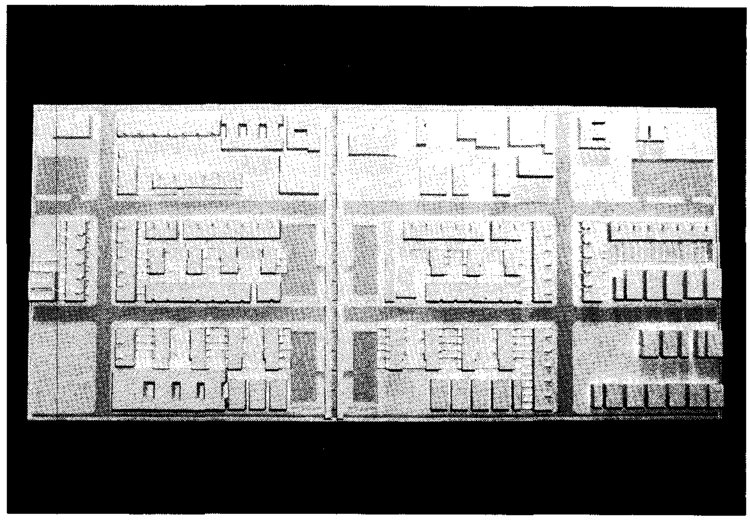
The architects have designed the light gray brick structures to form perimeter walls around this site so that housing turns inward onto an open public space in the core of the block. However, mews units have also been placed in this interior space, so that public open space is actually rather minimal, and only occurs at certain points, where it can easily be appropriated as the "turf" of adjacent units.

It is also interesting to note that the prototype called for depressing the duplexes' ground floor levels containing bedrooms a half-level below grade. Occupants entering from the street therefore climb a half-level to the living areas, where they can have easy surveillance of the street without loss of privacy. The rear garden court of the prototype is also at grade, therefore a half-level up from the bedrooms, and a half-level down from the living quarters. Somewhere along the line the UDC reportedly pushed for bedrooms above, living areas below, and won—for 50 percent of the units. For some unknown reason this decision to flip these ground-level units (the way the project will actually be built) is not indicated in the museum's visual presentation.

One change (actually a sacrifice) between the prototype and actual Brooklyn application does make it into the show, yet the reason for the change is unexplained. Instead of the ground level quarters being depressed a half-level below grade, they will be depressed only a third-level. Instead of the garden court being placed at grade, a half-level between ground level quarters and first floor quarters, it too is depressed a third-level. Thus the units with bedrooms on the ground level will have their gardens located almost a full flight down from the living area. Also because of this depression, garden courts are even more segregated from public open space. Privacy is thus ensured, but is after all a rather middle-class notion. Chances and opportunities for casual meeting and mingling would seem to be diminished.

Except for these points, the specific application in Brownsville follows rather closely that of the prototype. In the Fox Hill scheme, the connection is less apparent. For one thing Fox Hills has approximately half the density (31 dwelling units per acre, or 120 persons). The architectural treatment too differs: Fox Hills displays a nice system of set backs so that each of the flats has a terrace, and each of the duplexes has a garden (front and back). Because the scheme obviously didn't have to respond to the same high density criteria as Brownsville, it can provide more amenities, and a more varied formal expression of the architectural elements. But if the low-rise projects are supposed to relate to the Low-Rise High Density study, why is a Low-Rise Low Density scheme displayed?

Another question occurs: Given the facts that the intentions are good, that the architecture attains a high level formally and that the schemes are being built, why have these two projects been so singled out? There are other low-rise projects that are equally as good, or solve the problems equally well. These exhibited projects do not provide the end-all answer in terms of density, economy (reported to be about $30,000 per unit cost but rumored to be $45,000), sociological criteria with particular reference to public and private open spaces in Brownsville or to the open parking or even aesthetics.



Model of Marcus Garvey Park Village, Brownsville, Brooklyn.

The Institute, a private, nonprofit research, education and development agency with independent funding, was once allied closely to MOMA. In fact Arthur Drexler, Director of the Architecture and Design Department and director of the show, is still Chairman of the Board of the Institute. Both organizations also share some of the same benefactors.

The UDC and MOMA also have some of the same benefactors in common, e.g. the Rockefellers. So it is not surprising that some speculation exists that MOMA was instrumental in getting the Institute (not known for its large-scale built projects) hooked up with the UDC, using the show in the Governor's pinakothek as bait.

This kind of exhibit has a larger responsibility. Many low-rise, high-density projects have been built in recent years—a number in the Western Addition Redevelopment Area in San Francisco, others in Boston or New York (such as John Ciardullo's Red Hook housing in Brooklyn, or Werner Seligmann's housing for the UDC in Ithaca). All these schemes explore and solve (or raise) issues important to low-rise housing—density, parking, public/private open space, layout, to name a few. A genuine low-rise alternative show would examine all these responses, and present a range of those that answer most successfully these issues.

CHICAGO IN MUNICH

Starting on July 23, the State Museum for the Applied Arts in Munich, Germany—Die Neue Sammlung—will have an exhibition of "100 Years of Architecture in Chicago—Continuity of Structure and Form." Photographs, plans, models of both completed and contemplated projects, and a file of working drawings take Chicago architecture from the early days of the Chicago School until today.

The exhibit, which will travel to other European cities later this year, illustrates Mies' influence on the principles defined by the first Chicago School. Work of several Chicago offices is included: Skidmore, Owings & Merrill, C. F. Murphy Associates, David Haid Associates and others.

Oswald W. Grube, author of *Industrial Buildings and Factories*, an architect who worked for a few years in the Windy City, put the exhibit together in collaboration with Wend Fischer, director of Die Neue Sammlung.

TRANSPORT

THE BICYCLE CRAZE

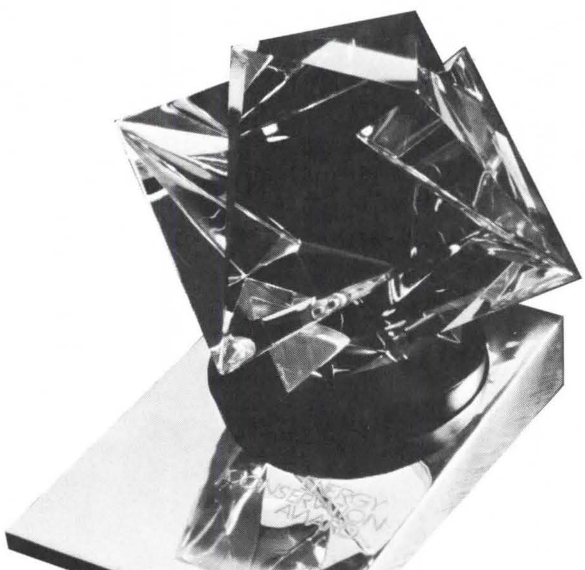
"Bikes are sexy," says a Boston graphic designer we know, who has a red ten-speed Italian bike. "They attract girls. It's not so much that mine is red. It's the white sidewalls."

"I finally gave up riding my bike in the city," says a pretty New York magazine editor. "It was attracting too much attention. At every stoplight someone would come over and ask

(Continued on page 30)

Do you have a building design that helps conserve our nation's fuel?

Show our Awards Jury a building design that helps conserve energy–and you could win one of the Energy Conservation Awards Owens-Corning will present this year.



The Owens-Corning 1973 Energy Conservation Award: "Triangles," a Steuben Crystal sculpture that captures and reflects light from multiple triangular planes.

The Awards Jury will be looking for three things: Creativity. Originality. And most important—*designs that save energy.*

Too many buildings waste fuel and contribute to environmental pollution.

By offering Energy Conservation Awards, Owens-Corning hopes to stimulate new ways to conserve energy. It also lets us honor the architects and engineers who do the best job of designing buildings and mechanical systems that conserve fuel.

Who can enter.

Any registered architect or professional engineer practicing in the U.S. is eligible. As an individual. Or in a team. But to qualify, your entry must be a commissioned *building* project—in the design

*T.M. Reg. O.-C. F.

process, under construction, or a completed structure.

Although Fiberglas* products are an excellent way to conserve energy, their use is not a requirement.

Four entry categories.

A winner will be selected in each of these categories:

Institutional—schools and hospitals, for example.

Commercial—office buildings, shopping centers, retail stores, and similar structures.

Industrial—including manufacturing plants, research centers, warehouses.

Governmental—post offices, administrative buildings, and military structures to name a few.

The Awards.

Winning architects and/or engineers will receive the Steuben Crystal sculpture "Triangles." Owners or clients associated with winning entries will receive other Steuben Crystal awards.

Send for entry details now.

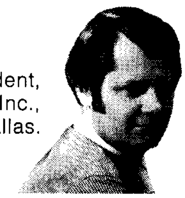
Completed entries must be submitted by August 31, 1973. Winners will be selected in September and notified in early October.

For a brochure giving complete details, contact your local Owens-Corning representative. Or write I. H. Meeks, Owens-Corning Fiberglas Corporation, Fiberglas Tower, Toledo, Ohio 43659.

The distinguished Awards Jury.

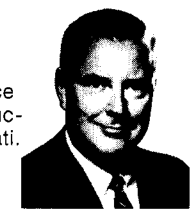
Winners will be selected by:

Walter A. Meisen, Assistant Commissioner Public Buildings Service, General Service Administration, Washington, D.C.



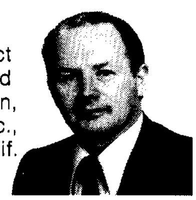
James E. Wheeler, President, Wheeler and Stefoniak, Inc., Dallas.

Ronald E. Aspgren, Chief Corporate Architect, Montgomery Ward, Chicago.



Robert B. Hollister, Vice President, Turner Construction Co., Cincinnati.

Professor Gifford Albright, Dept. of Architectural Engineering, Pennsylvania State University.



John A. Vincent, Project Engineer, Energy and Process Systems Division, VTN Consolidated Inc., Irvine, Calif.

Frank M. Lebman, President, Synergo Co., Philadelphia.

Owens-Corning is Fiberglas OWENS/CORNING FIBERGLAS TRADEMARK (R)

FACETS

(Continued from page 27)

Transport of the future?

me about it."

There are of course almost as many reasons for riding a bike as there are people who ride them. Last year in the U. S. between 11½ and 13 million bikes were sold (depending on whose figures you use) meaning that for the first time since the early years of the century more people jumped onto a new bike than into a new car.

Why? Some ride because they say it preserves their sanity in a world gone mad. Some like the competition, riding in packs around closed courses, heads down, legs pumping rhythmically. A few are in it for the equipment. They are endlessly taking their bikes apart and putting them together again, filing out their tubular frames, adjusting tire pressure and discussing the advantages of *derailleur* change speed gears or the Sturmey Archer hub gear. There can be little doubt that for short distances a bike is a freer, more sensual means of transport than a ride in a steel box.

It is also the most efficient means of transport known. And this factor in an energy conscious age is no small one, whether it is generally recognized or not. Engineer and bike enthusiast S. S. Wilson writing in *Scientific American* explains the energy factor this way: "When one compares the energy consumed in moving a certain distance as a function of body weight for a variety of animals and machines, one finds that an unaided walking man does fairly well (using about .75 calorie per gram per kilometer), but he is not as efficient as a horse, a salmon or a jet transport. With the aid of a bicycle, however, the man's energy consumption for a given distance is reduced to about a fifth (roughly .15 calorie per gram per kilometer). Therefore, apart from increasing his unaided speed by a factor of three or four, the cyclist improves his efficiency rating to No. 1 among moving creatures and machines."

It is ironical that the bicycle, the first machine to be mass produced for personal transportation, helped make the motor car possible. Early cars ran on roads that had been improved for bikes and many technical inventions made for bikes such as the tubeless tire and the differential, became standard parts of cars. Now it is probably the car as much as anything else that is spurring the return to bikes. Bikes make no noise, spew no evil smell. If you ride consistently, you may end up with a waistline that looks, in the right light, like Mohammed Ali's or Jill St. John's.

Enough pressure has come from bike riders to make politicians respond. Across the U. S. cities and states are starting to plan for bikes as transportation and to raise the money needed to implement the plans.

- Oregon siphons off one percent of its gasoline taxes for bicycle paths.
- Aspen and Denver, Colorado, have started construction of special bike lanes through city streets. So has David City, California, a city of 25,000 people and 18,000 bikes.
- A bill before Congress, proposed by Rep. Alphonzo Bell of California, would call for bicycle racks in 450,000 government buildings.
- Two bills, one in the House, one in the Senate, call for the tapping of the Highway Trust Fund to build bicycle paths, shelters, parking facilities and traffic control devices.
- The Transportation Department has plans to link bike trails into the Bay Area Rapid Transit System. Bikers could ride up to a station, lock up their bikes in special racks or rooms and catch the next train.
- Ann Arbor, Michigan, earlier this year approved an $800,000 bond issue for the creation of 90 miles worth of city bike lanes.

These efforts are not without difficulties. For one thing they are expensive. A recent study in Atlanta showed that a full bikeway network for that city would cost $20 million. If instead they painted off bike lanes on city streets it would cost only $2 million. But bike lanes on city streets are not that safe. According to California highway patrolman, Robert Rieber, who spoke at a recent bike conference, some 25,000 Californian cyclists will be killed or injured there this year. Cars and bikes don't mix. But then neither do cars and others cars.

TOURISM

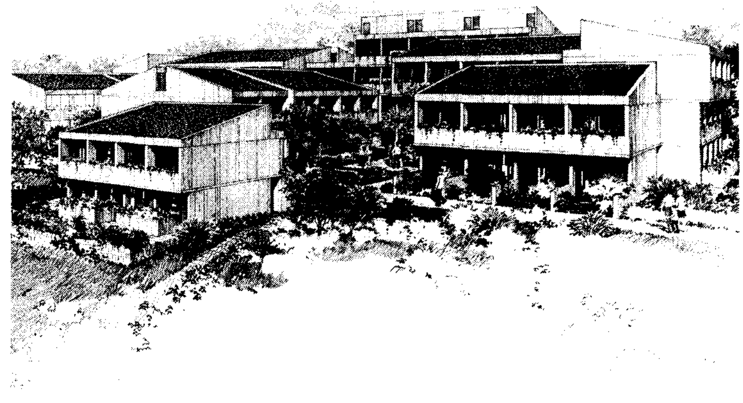
ON THE ADRIATIC

Edward Durell Stone's design for a resort community on the Yugoslav coast shows nine hotels built into the hillsides of a peninsula, not far from the walled city of Dubrovnik. Ever since he saw the Taj Mahal, Edward Stone has tried to make his buildings white and these, to be constructed of off-white, poured concrete are not really exceptions. The site has high cliffs overlooking the sea, olive groves, stands of pine, rocks and shrubs. These will be kept and augmented by landscaping being planned by Edward D. Stone, Jr. and Associates. Walkways of off-white stone will connect the hotels with one another, with market centers, with restaurants, the sea and an open air theater and playgrounds.

Babin Kuk, which means "grandmother's hip," is the name of both the 500-acre peninsula and the development. The community will accommodate 5,000 overnight guests and 3,000 daytime visitors in a blend of the old and the new. Cars will be banned from the grounds, for instance, and the hotel buildings, all of which are three stories, will have entrances on the second level, eliminating elevators. On the western tip of the peninsula will be a luxury hotel, surrounded by a green-belt for privacy and protection from the Adriatic winds. Four hotels will be Category A hotels and another cluster of four, to be used only in summer, will be Category B.

Owned by HTC Babin Kuk-Mincetta, a Yugoslavian firm, the resort is being financed by the World Bank and by the Privredna and Dubrovnik banks in Yugoslavia. Yugoslavian architectural associates on the project are from the cooperative Architektonski Biro Centar 51.

(Continued on page 32)



Adriatic resort by Edward Durell Stone.

On Reader Service Card, Circle 316

CONSERVATION

ADIRONDACKS THREATENED

If it's open land—pave it! seems to be an emotional appeal heeded by developers and bureaucrats alike. One of the largest underdeveloped tracts of land east of the Mississippi is in New York's Adirondack Park. Its six million acres make it about the size of Vermont, but 3.7 million of those acres are privately owned. Not bad in itself, private ownership means that the land can be sold to those who would pave it, and that, of course, is what is being done.

This Spring, a hastily passed state law limited the area to a maximum population of 2 million persons and detailed land use precisely. The privately held acreage will be placed under stiffer controls than those imposed by individual communities.

But passage of the bill was not without controversy, and Governor Rockefeller had to veto a bill to delay the plan for a year before it could be signed into law.

The development that brought things to a head was a plan for 24,345 acres to be turned into some 9,000 lots for from 21,000 to 35,000 persons. It was the scheme of a major developer from the southwest, who may now have tougher sledding.

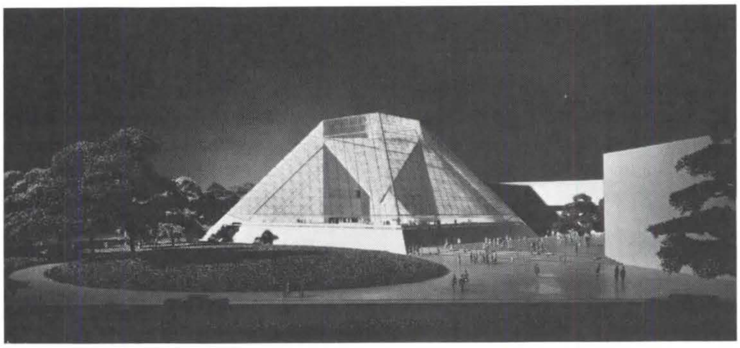
But others are not to be put off so easily. A tract of 18,500 acres north of Tupper Lake in the midst of the park may become a second home community for 20,000 because the town's zoning laws were enacted before July 1971 and so are not effected by the new bill.

Already a stricter law is needed. Stewart Udall, former Secretary of the Interior was only stating the obvious, when he said, "If the large scale land speculators are allowed to invade the Adirondack Park with their lot sales schemes, this could mean the gradual dismemberment and degradation of one of the nation's finest conservation resources."

EVENTS

THE KENNEDY LIBRARY

Long awaited, the design of the John F. Kennedy Library, to be built on the Charles River in Cambridge, Mass., was announced in late May—sooner than expected to coincide with JFK's birth date. As seen in the model by I. M. Pei and Partners, the design is a combined public archive and public monument; indeed, there are two distinct facets to it. One will house the Kennedy archives, Harvard's Kennedy School of Government and the Institute of Politics. It is a five-story (55-ft.-high) right-angled building with a dramatically curved facade facing a multi-leveled courtyard and a museum. The museum is a pavilion - style building covered by an 85-ft.-high truncated glass pyramid.



Model of the Pei designed museum.

Although the heights and spaces will be in scale with the neighboring Harvard University buildings, the site (5.25 acres for the Library) is a relatively large one and many neighbors are concerned the institution will draw more than the some 600,000 persons per year, the official estimate. If neighborhood fears are correct the 400 planned parking spaces may be woefully inadequate. These and other community-related aspects of the scheme are still being negotiated. And it looks as though it will be several more months before the final configuration of the complex is set.

BIG THINK

AND NOW WHAT?

In early May, a 35-ft. white steel beam, carrying the signatures of thousands of Sears, Roebuck & Co. employees, was hoisted into place at the highest point of the Sears Tower, 1,454 feet above Wacker Drive in downtown Chicago. Its steel work completed, the Tower became the tallest building in the world, surpassing the World Trade Center, which had held the title briefly, by 100 feet.

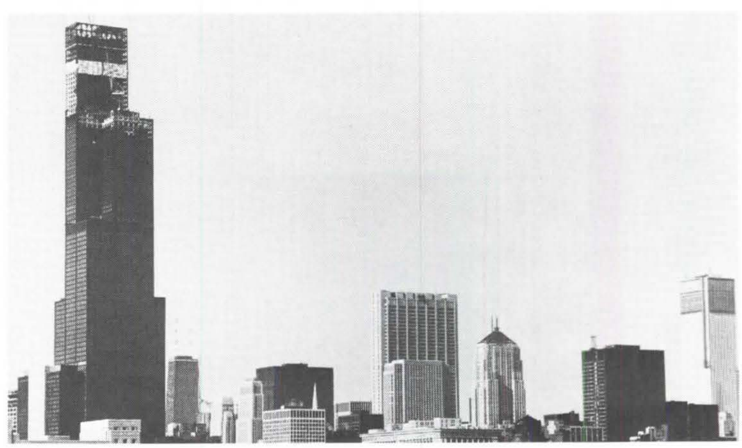
As part of the ceremonies, four electricians, calling themselves the "Tower Bums", belted out a tune they had composed for the occasion. It's lyrics went like this: "She's the tallest rock built from the smallest rock, she's not a hand-made rock, though she's a man-made rock." Puzzling though the song may have been, there is nothing puzzling about the Tower itself or its seeming efficiency.

Its structure is what designer Bruce J. Graham of the Chicago office of Skidmore, Owings, & Merrill describes as a "bundled tube system." Nine tube-like frame structures (columns are placed on the perimeter and at the core, leaving interior space free) are bunched like a bundle of sticks. But only two of these tubes rise to the top of the building. Two stop at the 50th floor, two at the 66th floor and three more at the 90th.

With 4.5 million sq. ft., it is the world's largest private office building. And when completed sometime next year (Sears employees will start moving into the lower 44 floors late this summer), it will house 16,500 workers.

An all electric building, the Tower will have its own power center, said to be large enough to supply a city the size of Rockford, which is the second largest city in Illinois. In fact, 18 floors, 15 above, three below ground, are devoted to mechanical support systems. There will be 103 high speed elevators, 16,000 bronze tinted windows, 145,000 light fixtures.

The obligatory observation deck will be on the 103rd floor, beneath seven floors of mechanical penthouse, but even the 103rd floor, Sears officials quickly point out, is higher than any other building.



Sears Tower topped out.

STREETSCAPES

CALDER FOR MIES

A new Alexander Calder stabile will rise a venturesome 53 ft. above the plaza of the new 42 story Federal office building in Chicago next year. Calder, for whom Chicago's winds posed a special artistic problem, had to thicken and strengthen parts of the sculpture. "This is supposed to be a stabile," he said, "But we have to be careful it doesn't become a mobile."

Calder's fee ($250,000) and the cost of construction and erection ($75,000) come from the General Services Administration's arts program under which one half of one percent of a GSA building's cost is set aside for art. This is the first time the art budget has been used, and it appears to have been used well.

The stabile will become an ornament of the three building Federal complex, which besides the new office structure includes

(Continued on page 98)

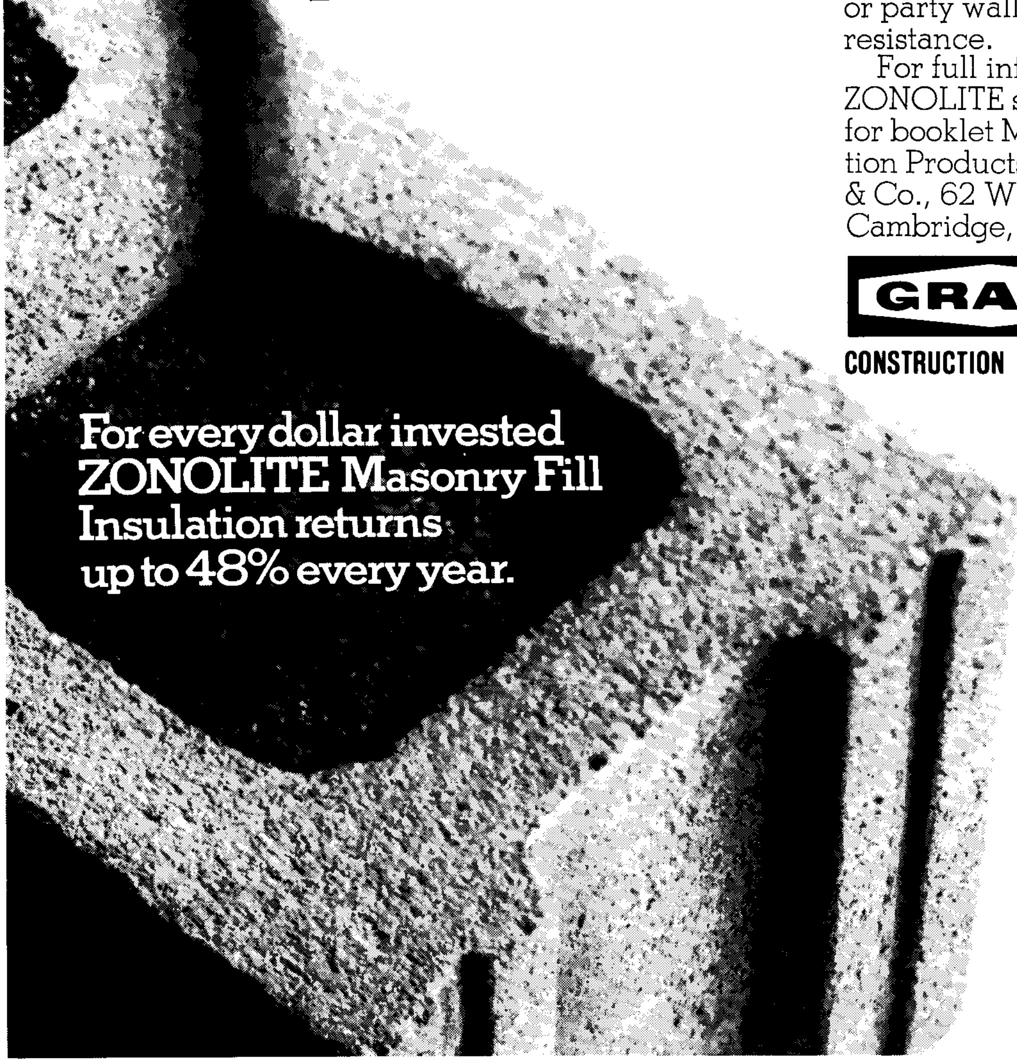
ZONOLITE® Masonry Fill Insulation, poured into cores or cavities of masonry walls, usually reduces heat loss by 50%—and more in some cases.

To the owner, this means his insulation cost is paid back to him in two or three years. Then savings continue year after year. A fact that should be of importance to every specifier or builder.

Heating and cooling savings are impressive in every area. Example:

	Chicago	Atlanta	Mpls.	Phila.	Denver
Combined Heating/ Cooling Savings*	**$6400**	**$3500**	**$8150**	**$6450**	**$5400**
Installed Cost of Insulation	**1700**	**1700**	**1700**	**1700**	**1700**
Average Annual Return on Insulation Investment	**38%**	**21%**	**48%**	**38%**	**32%**

*10-year savings from insulating walls; 8" lightweight block; 2-story office building, net exterior wall area 10,000 sq. ft.



The new FHA standards for multi-family housing require masonry walls to have a heat loss factor ("U" value) no higher than .17. ZONOLITE Masonry Fill is the most economical way to bring block walls into conformance—as low as 17 cents per square foot installed, for 8" block.

In addition to cost savings, consider these important features:

Improves comfort—Inside wall temperatures are increased up to 13°F. in winter. Body-to-wall radiant heat loss is reduced. Greater comfort results. Summer conditions are improved, too.

Increases fire resistance—Adding ZONOLITE Masonry Fill to a 2-hour fire-rated lightweight block gives more than four hours extra protection—earns 4-hour UL rating.

Cuts sound transmission—Users report that Masonry Fill in exterior or party walls improves the sound resistance.

For full information, contact your ZONOLITE sales office. Or send for booklet MF-164A, to Construction Products Division, W. R. Grace & Co., 62 Whittemore Avenue, Cambridge, Mass. 02140.

GRACE

CONSTRUCTION PRODUCTS

On Reader Service Card, Circle 317

Steel Comes to Life

Presenting the 1972-73 Design In Steel Awards

Steel. As flexible in its myriad applications as the mind of the creative individual who shapes it to his needs. The architect, for example, bringing steel to life.

Testimony to steel's importance in creating the structures of our world are these award-winning designs.

A home of steel in New Jersey, in perfect harmony with its natural surroundings.

An electrical sub-station in California, with power lines resting on 80-foot tall "portal" towers of steel.

A four-building cluster in Toronto that focuses on a 57-story tower, clad in stainless steel.

All aesthetically superior, and with the strength and enduring quality of steel. All possible, thanks to creative man's ingenious application of this most useful of all metals.

To these architects, designers, engineers and artists and their imaginations, American Iron and Steel Institute dedicates its sponsorship of the Design In Steel Award Program.

Awards Judges:

SEBASTIAN ADLER
Director, Contemporary Arts Museum, Houston, Texas

ARTHUR N. BEC VAR
Chairman of the Board, Industrial Designers Society of America; Fellow, IDSA

HAROLD A. BOLZ
Past President, American Society for Engineering Education

S. SCOTT FEREBEE, JR.
President-elect, American Institute of Architects; Fellow, AIA

WILLIAM M. GOLDSMITH
President, Industrial Designers Society of America; Fellow, IDSA

GEORGE F. HABACH
Past President, American Society of Mechanical Engineers

ROBERT S. HARRIS
President-elect, Association of Collegiate Schools of Architecture

THOMAS M. MESSER
Director, The Solomon R. Guggenheim Museum, New York, New York

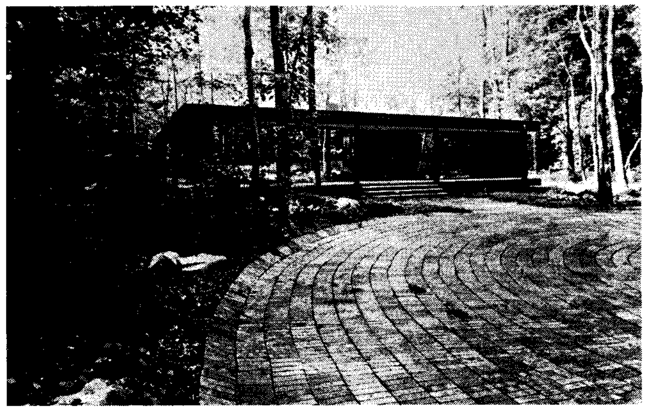
GERALD NORDLAND
Director, Museum of Fine Art, San Francisco, California

ARTHUR J. PULOS
Executive Vice President, Industrial Designers Society of America; Fellow, IDSA

JOHN E. RINNE
President-elect, American Society of Civil Engineers; Fellow, ASCE

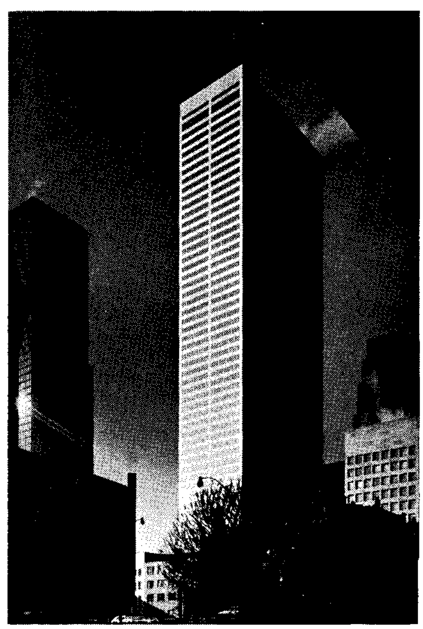
MAX O. URBAHN
President, American Institute of Architects; Fellow, AIA

Structures



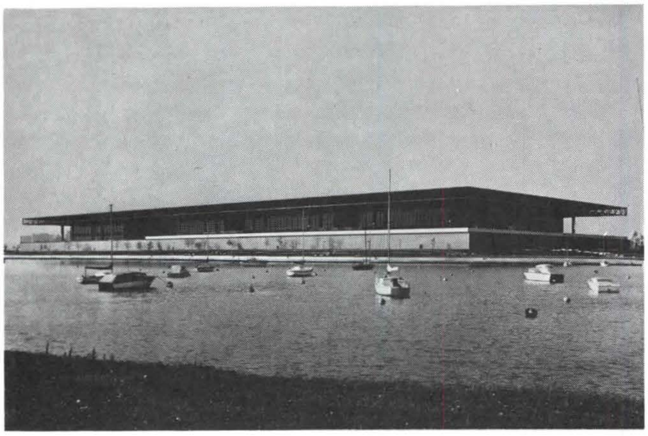
R. Hillier

BEST DESIGN in Housing was won by Robert Hillier, an architect who designed his own home, flooded by ever-changing sunlight through a central skylighted atrium. Steel was used extensively throughout the home as well as for the frame and for the stud wells. Only the doors, jambs and recessed moldings are of wood.



I. M. Pei

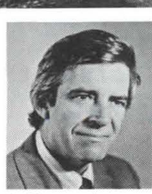
BEST DESIGN of High-Rise Architecture was awarded to members of the New York architectural firm of I. M. Pei and Partners for their work on Commerce Court in downtown Toronto. The project, built as headquarters of the Canadian Imperial Bank of Commerce, is a four-building cluster that focuses on a 57-story Tower, clad in stainless steel.



G. Summers

BEST DESIGN of Low-Rise Construction was awarded to members of C. F. Murphy Associates for the planning and execution of McCormick Place On-The-Lake, an expansion of McCormick Place, the exhibition center undertaken for the Metropolitan Fair and Exposition Authority of Chicago. Featuring a steel truss roof system supported on 50-foot-high columns, the expansion involved 3,390 linear feet of steel bulkhead placed in the lake and backfilled to provide 11 acres of additional parkland.

W. Conklin,

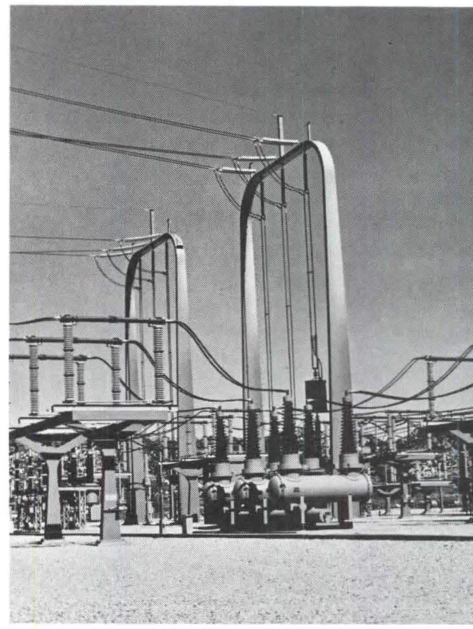


J. Rossant

L. Zetlin

Dr. C. Thornton

BEST ENGINEERING of Low-Rise Construction is shared by the engineers of Lev Zetlin Associates and the architects Conklin and Rossant for this superbay maintenance facility, erected at two airports and expected to serve as a prototype for other such structures. Requirements for the maintenance facility demanded new and special solutions in the development of environmental enclosure systems for maintenance operations.



C. Wiseman

BEST DESIGN in Public Works is awarded to the Architectural Design Section, Southern California Edison Company, for this aesthetic electrical sub-station in Castaic, Calif. Power lines into the sub-station rest on 80-foot tall "portal" towers, designed in the shape of a croquet wicket. These towers are modular and are added to, side-by-side, as the number of circuits increases.

J. Shedd

BEST ENGINEERING in Public Works goes to Jack P. Shedd, Howard, Needles, Tammen and Bergendoff, for this 930′ long, single-track, railroad bridge, spanning Spokane, Washington's Indian Canyon. Considered an unusual construction technique for a railroad bridge, the composite design with its welded weathering steel box girders incorporates optimum function, excellent appearance and low cost. Over 1,590 pounds of weathering steel per linear foot of bridge were used, including eight spans ranging from 100′ to 150′. The four-span continuous unit stands 140′ above the canyon floor.

AMERICAN IRON AND STEEL INSTITUTE
150 East 42nd Street, New York, N.Y. 10017

Steel

On Reader Service Card, Circle 318

"In one potato there are mountains and rivers." A Japanese poet said it centuries ago.

Making poetry from potatoes was the passion of John de Menil who passed on last June at Houston.

This Parisian turned Texan had a special kind of energy. Leaving school at 17, he went into banking as a messenger, worked his way up while earning three degrees and, beginning 1938, put the oil detection process of the Schlumberger company on a global footing—the wellhead of far-flung philanthropy.

Mr. de Menil's energy was more than financial however. It was spiritual. And this example, as much as his generosity, helped others acquire and apply it through creative, constructive effort. After moving from Paris to Houston in 1940, he and his wife Dominique set out to encourage innovation in, and communion between, the fields of art, science and religion. These were *one* field to them, going back to the root word *religio*—meaning to bind together.

What followed was a cultural Spindletop.

They set up an art department at Houston's University of St. Thomas and brought Philip Johnson to do the campus. Moving on, they endowed Rice University's Institute for the Arts and, still later, its Media Center. Also reflecting the de Menil light are the Houston-based Institute of Religion and Human Development, various programs in medical and psychiatric research, and a Blacks-to-College fund for promising students including an art historian at Yale, a medical student at San Diego, and a Houston politician. Many more made it through, never knowing where the tutoring and tuition money came from. This is only natural because Mr. de Menil liked sharing his resources in such a way that you ended up thinking they were your own.

The house Philip did for them out in Houston's River Oaks section left you feeling the same way. Far more than a showplace, it was thoroughly lived in and became a stomping ground for all sorts of saints—film makers, folk singers, poets, authors, physicists, physicians, celebrated artists and architects, philosophers, theologians, struggling students. I say saints, because that is what he believed everyone is born to be.

The house also became the core of an art collection ranging 5,000 years—one begun in 1932 with a $10 Picasso. This, in turn, became the central asset of the Menil Foundation, set up ten years ago—around the time he and Dominique became naturalized U. S. citizens.

The collection, of which Mr. de Menil was curator after "retiring" as chairman of Schlumberger in 1970, includes art and artifacts of the South Seas, Africa, Pre-Columbia, the Indians of the Northwest coast, India, Cyclades, Greece, Rome, Byzantium and the Renaissance. Works of cubism, surrealism and the more recent experiments in technological art also abound. At the end of his life, the de Menils were busy adding pieces from the Iron Age and rounding out their African and Greco-Roman collections. In this, they were awfully well matched. Being the more scholarly and organized of the two, Dominique could carry out with precision what he offered with reflection.

Many first rate exhibits here and in Europe were carried out, as were catalogues. One project particularly close to Mr. de Menil's heart was the three-volume "Iconography of the Black," to be published next year, portraying black people through their art over time. Another was his sponsor-

Photograph: Ed Rica

Dominique and John de Menil at their Houston home.

ship of Roberto Rossellini's 12-part film *Science* for telecasting in a series of one-hour specials.

The de Menil embrace of art was not eclectic, as it might appear to a casual observer. That embrace was ecumenical. However many exhibits they put on the road, however many museum installations they sponsored, Mr. de Menil was slightly impatient with those neat, curatorial rows which Viollet-le-Duc complained about as reducing art to just so much "plucked fruit" instead of looking into "the living tree that produced it."

In amassing art, he was bent on amassing greater harmony among people of different faiths, living in different political systems, using art as an ecumenical tool. As a close friend recently put it, "He found constant confirmation of mankind's innate spirituality everywhere he went"—something borne out by his last pilgrimage in 1972 when he visited Lebanon, Egypt, West Africa, Iran and India.

This trip led out of the de Menil project that best sums up their sense of life which, need it be said, is basic to a sense of art. This is the now-famous Rothko Chapel near the University of St. Thomas which they endowed as a symbol of ecumenism.

Dedicated 1971, and designed by Howard Barnstone with Gene Aubry, the small, monastic structure was described by Father Youakim Moubarac of the National Center for Scientific Research at Paris, as a "no-man's land of God's truce."

Fourteen immense, meditative paintings by the late Mark Rothko set off an octagonal room which serves as a meeting place for the faiths: Jews, Christians, Moslems, Buddhists, Shintoists, Hindus, native Africans, Sufis, American Indians.

The Chapel's simplicity is becoming to the common ground being sought. In July, for example, it housed a colloquium dealing with traditional modes of religious contemplation and, as important, modes for modern-day participation in solving the spiritual and social problems of the world's peoples. Next December there will be an observance of the 25th anniversary of the United Nations Declaration of Human Rights.

Outside the Chapel, poised in a reflecting pool, is Barnett Newman's 26-ft. "Broken Obelisk" in Cor-Ten steel. The late Mr. Newman, like Mr. de Menil, considered art as moral example, and created the obelisk in 1967 to stand outside Washington's Corcoran Gallery, which it did until 1969.

Early that year, the Houston Municipal Art Commission, hoping to take advantage of a federal program encouraging great art in public places, turned to the de Menils to help match a government grant of $45,000. Word came back that they would give it all *if* the work were "Broken Obelisk," *if* they were allowed to approve the site, and *if* it were dedicated to the memory of Dr. Martin Luther King, Jr.

The Commission had already chosen a site in front of City Hall and didn't want to rock the racial boat. Mr. de Menil seemed amenable, suggesting instead that it be inscribed, "Forgive them, for they know not what they do." Indeed they didn't. Demurring, City Hall came out for an absolutely stunning depiction of America's first moonwalk, and thanked the would-be benefactors very much. Mr. de Menil had made his point, though perhaps it was not his initial intention to do so. The obelisk stands there today—an outright gift to Houston, a tribute to Dr. King, and a reminder that the better instincts of mankind may yet prove to be more tenacious than the worst ones.

Mr. de Menil really believed in that. And if his kind of faith seems out of sorts with what we tend to think of as the "real world," remember that the "real world" may be out of sorts, failing to believe. He found it very hard to look at things as just old or new, black or white, even as good or bad. More constructively, he looked at things in terms of being fulfilled or unfulfilled, and did his best to subdue obstacles for both the individuals and the communities he touched. Raising sights, not monuments, was his aim. And to think of him as just a "patron" couldn't be wider of the mark he left.

Remembering back a couple years, he gave a little supper at the house one night. Little suppers, like every other moment of the day, were artistic opportunities. Moving into the dining room after several hours of good talk, he motioned for the lady on his arm to sit down across from whatever painting she liked best. It was a big Braque, if memory serves. Then, behaving like any old peasant who loves having a good time, John de Menil passed around the best *au gratin* potatoes any of us had tasted, before or since.—WILLIAM MARLIN

FORUM

JULY-AUGUST—1973 VOL. 139 NO. 1

ARCHITECTURE AND ENERGY

BY RICHARD G. STEIN

The energy crisis? The energy shortage? These terms are being used to describe a situation which needs, to say the least, more exact definition.

The energy *imbalance*?

There *is* an imbalance between energy use and energy availability. It might be said that our "crisis" has been brought about by having failed to come to terms with managing this imbalance, with bringing use and availability into phase. Doing so, or failing to, will have fundamental implications for the architect and allied professions.

There is an anomaly amongst us, and it has to do with the fact that we are designing and building structures that are the very opposite of what they purport to be. The underlying idea—found in all architectural design and criticism—is that design decisions derive from programmatic needs, and that resulting building forms derive from solving those needs rationally, using materials and techniques at hand, considering their placement in a setting.

The tremendous increase in energy use by these buildings has forced a re-examination of whether we do, in fact, do what we say we do.

Has our fourfold increase in electric energy use, in the past two decades, produced a comparable increase in the quality of life?

If not, how do we explain the path we have chosen?

This grating question, encompassing most areas of life today, is the dilemma underlying this and other investigations of energy use in building.

The "energy crisis" has become so familiar through magazine articles, utility and petroleum advertisements, symposia and meetings, that it can be written, for all intents and purposes, as a single word. Certain statistics and facts are accepted in virtually all such presentations; for example, the record of energy use to the present time in the United States—very well documented, very instructive information. Future projections, estimating recoverable resources, are less dependable, although there has been a fair amount of consistency in these figures to date.

In the course of this article, I will not be arguing about the existence or the dependability of such projections into the future. I will be questioning them as unfounded, unnecessary and unrealistic. My position is that accepting, then working to achieve, a continuing, exponential energy increase has more than a slight touch of madness—even if slightly blunted.

The starting point, or so it seems to me, should be to assess the national and world energy picture.

The situation in New York City, that of chronic brown-outs, is being repeated all over the United States—in California, the Southwest and Midwest. There are very few areas not manifesting some form of energy shortage—in electric black-outs and brown-outs, in gas shortages requiring curtailment of new installations, in oil shortages resulting in heating emergencies and industrial shut-downs, and in inadequate supplies of low-sulphur coal for power generation.

This is not just a momentary shortage, but one with all the earmarks of increasing as a crisis for the next two to three decades. The only possible alleviation which has been indicated thus far is that of solving the immense technological problems connected with fusion or, possibly, solar generation.

For further perspective, there has also been a constantly mounting level of pollution—the heating of air and water, the problems of radioactive waste management, the difficulties in siting new generating facilities, the vast acreage needed for transmission lines, and the disproportionately high energy use in the United States.

While the symptoms of shortage can be cured by making more energy available, the less obvious but more fundamental symptoms will only be aggravated by increased energy consumption.

I would like to repeat an analogy made by Buckminster Fuller. Realizing that the source of all fuels (all energy) is the sun, Dr. Fuller has pointed out that some sources (like coal and oil), formed over long periods of time, stored in the earth, are analogous to money in a savings account. Others which are constantly renewed—the sun itself, wind, wood, precipitation or animal labor—are analogous to income. He pointed out that up until the Industrial Revolution, we lived within our energy income; only when we became dependent on a machine technology did we start dipping into our energy savings. He concluded that you can't live on your savings forever. Something everyone knows.

At present, the greatest (or loudest) response to the energy crisis seems to be in the direction of discovering new, greater reserves of fuel, and new sources of power. To follow Dr. Fuller's analogy, we're looking for more usable income by developing such sources as solar energy but, in the meantime, we hope a rich uncle somewhere has left us a lot of oil.

The suppliers of energy and fuels, the enterprises selling energy-consuming devices, feel that the solution is to continue expanding energy use, and to increase the availability of fossil fuels by reducing environmental constraints, thus providing economic and tax incentives. It is thought that by exploiting the remaining untapped energy sources—off-shore, in Alaska, the rest—we will offer a few years more time before conditions require drastic change.

Even if there were an abundant supply of fuel to be converted into energy, I feel it would be important to question every energy use to see whether the energy was being efficiently provided and used.

This is especially true for the architect. Our actions are not just individual, isolated, personal ones; they affect the energy used by many people for long periods. More than a third of all energy used today results from previous architectural and building decisions. This fact of energy life, so to speak, can be modified somewhat, and the future use of energy in new buildings sharply reduced, if we alter some basic attitudes now widely held in the design professions.

The Interchangeable Shortage

Our consumption of energy has been predicated on an inexhaustible supply. That is the attitude we are accoustomed to. Furthermore, it has been predicated on a *cheap* supply.

The supply, lest the fact escape you, is neither inexhaustible nor, by all accounts, will it remain cheap.

America is primarily dependent on fossil fuel as the basic energy source. Domestic sources are dwindling and are becoming more difficult and expensive to extract. The conversion process, even under the most stringent controls, creates pollution and environmental degradation to the air, water and earth's surface. This takes many forms—thermal pollution, particulate pollution, chemical and photochemical pollution, and long-range changes in the make-up of the atmosphere and the patterns of weather formation.

Right now, the only other significant sources of energy being exploited are hydro-power, nuclear power and, to a minute extent, geothermal-based power. Together, they represent about five percent of electrical energy, or about one percent of the total energy we depend on.

Even if the projected proliferation of nuclear plants is accomplished, they will constitute a minor fraction of our total en-

---

Mr. Stein, FAIA, is a New York based architect and teacher. He would like to acknowledge the contributions to this article from his associates, particularly Diane Serber, AIA. Some of this material was developed for the AIA Task Force policy statement on energy conservation.

ergy requirements in the year 2000. The bulk will still come from fossil fuels.

Projections call for about three times the present fossil fuel use 25 years hence—this, at a time of increasing international competition for petroleum. While projections about future imports vary, based on trends, there is agreement that between 1980 and 1985 we will be importing 50 percent of our petroleum. Why the sustained dependence on petroleum? Because the nuclear sources have not produced the low-cost energy which was initially projected. And neither the light-water reactor nor the liquid-metal fast breeder are free of pollution or low in cost.

There seems to be a tacit, ever growing lack of confidence in nuclear reactors as the source of electric generation which will, we are given to understand, take over from the fossil fuel sources. Two recent announcements seem to confirm this.

The New York Times recently described a major coal gasification facility to be built on a Navajo reservation at a cost of many hundred million dollars. A second article described a 50,000-megawatt, coal-fired complex in the Rocky Mountains. These shifts in primary fuel mesh with energy crises in other areas.

Gas and petroleum are in increasingly short supply when measured against either present use or exponential growth projections. Natural gas is unavailable for new industrial, commercial or institutional installations in New York, and in other parts of the country. In order to overcome delivery limitations imposed by pipe lines, a fleet of liquefied natural gas tankers is being built to import natural gas to the United States, although present cost projections list this gas as three to five times as expensive as domestically captured gas.

On June 14, 1973, The *Times* reported that Rogers C.B. Morton, Secretary of the U.S. Department of the Interior, rejected permits for a coal-fired 8,250-megawatt generating plant in southern Utah, the Kaiparowits Plant, because of the adverse environmental effects. Its emissions, along with those of the nearby Navajo plant under construction "can be expected to have a dramatic effect on nearby canyons of the Colorado River." Impaired visibility as far down river as the Grand Canyon was also pointed out in 1972 by the Environmental Protection Agency in a statement to the Interior Department.

According to a Bureau of Mines assessment of global resources as analyzed in the controversial book, *Limits to Growth,* our fossil fuels are being rapidly depleted. These projections were based on various assumptions—the longest range assumption being five times the world's resources of a material as now known subjected to exponentially increased use. Other projections were based on continued rates of present use applied to estimated world use and supplies of resources. According to these projections, natural gas will be used up in 38 years at the present rate. It will be exhausted in 22 years, that is on a world scale, if its use increases exponentially as it has in the past or, with five times the known resources of natural gas, it will be exhausted in 49 years.

Petroleum, sorry to say, is no better. The figures in this case are 31, 20 and 50.

Coal, at the present rate, has a life expectancy of 2,300 years. However, if the present rate of increase continues (and with gasification it would be increasingly exploited), it will be exhausted in 111 years. If, say, reserves of five times the known resources were uncovered and made available, they will be exhausted in 150 years.

To make the problem even more critical, the United States uses 44 percent of the world's total coal consumption, 63 percent of the world's total natural gas consumption and 33 percent of the world's total petroleum consumption. One wonders whether the world will long tolerate the tremendous discrepancy between American utilization of energy in contrast to the low per capita energy use elsewhere.

Shifting from a scarce energy source to a momentarily more abundant one offers no particular encouragement. Gas and oil are used interchangeably for heating. Coal is used directly as well as indirectly through coal gasification and electricity production. Electricity, produced by gas, is used for heating—this, in competition with that heating done directly by gas.

No. Two Oil is burned in gas turbine generators to heat houses that have since turned to electricity because they can no longer get No. Two Oil. As an option, refineries can refine petroleum for gasoline, for home heating oil, or for producing petro-chemical synthetics. As long as we have our primary commitment to fossil fuels, as we have for the next three decades at least, the shortages will have to be countered by changes in every energy-consuming field.

New Energy Applications

First off, we must realize that energy is not the only thing in short supply. The shortage of other materials is becoming critical. For minerals, as an example, there is a very short time span.

Let's look again at *Limits to Growth*—a summary of the views and recommendations of the Club of Rome, put together at Massachusetts Institute of Technology under the direction of Dennis Meadows.

To be sure, this little book has cracked some heads (and consciences) together. But while it contains points I disagree with, there is much of use in it. I do not agree, for instance, with the book's premise that a series of broad assumptions, put into a computer relationship, can automatically yield the truth. There are dynamics that modify such gross predictions. However, looking farther into the book, there is that chart we mentioned earlier based on the Bureau of Mines study, the one indicating the rate of exhaustion of non-renewable resources around the world.

Aluminum, at the present rate of use, would (according to this source) last 100 years more. And, at an exponential rate of use, just 31 years.

Copper, at the present rate, would last 36 years. And, with the exponential increase, 21 years. If we assume that five times the known supply were discovered, copper would last another 48 years.

The figures for gold (be patient) are 11, 9 and 29 years.

The figures for iron are 240, 93 and 173.

Lead weighs out at 26, 21 and 64; mercury at 13, 13 and 41; silver at 16, 13 and 42; tin at 17, 15 and 61; tungsten (used in high-grade steels) at 40, 28 and 72; and zinc at 23, 18 and 50.

Second and third story windows in Pueblo Bonito, New Mexico.

We shouldn't need a word of caution here, but we do. Specifically, even obviously, such continuing exponential growth rates cannot go on indefinitely in a finite world.

You may remember the story of the person who asked the Caliph to be paid by receiving one grain of rice for the first square on a checkerboard, doubling it on the second square, and so forth. You may further remember that before he was half way through the board, all the rice in the Caliph's country had been promised to this man.

This is characteristic of exponential rates. At a certain point, such rates exceed the capacity of the real world to deal with them.

A United States Geological Survey report, released May 18, 1972, comes to a similar conclusion. It said that materials may be in such short supply that this will be the limiting factor in determining how much we produce, and how much energy we need.

What are the alternatives? How promising are they?

The search for new sources of the basic metals, or for substitutes, may well be our major problem in the future. However, the present problem is the energy supply. In this respect, at least, we can see alternate sources at hand, or on the horizon. Thing is, some of these sources are not very dependable at yet. Some involve major safety hazards, unacceptable price tags, and some have not yet yielded the secret of how to achieve them.

Nuclear Generation

Serious problems are becoming apparent in the nuclear field. There have been failures in the fuel rods of reactors to account for, as well as failures in long-existing applications of nuclear generation.

Already, certain utility companies are voicing disillusionment with the light water nuclear generators, three of which projected for the Potomac River area have been dropped from the growth program of that region.

Mr. Louis H. Roddis, President of Consolidated Edison, was quoted in the *Times* (November 19, 1972) as saying that his company expected 80 percent efficiency in the lifetime of Indian Point One, in New York's Westchester County. In fact, it has been producing only 40 percent of the time for the ten years it has been in operation. Mr. Roddis further stated that the difficulty involved in maintaining the generators was greater than had first been anticipated. For example, repairing a cooling line break—a job which would have taken two weeks and 25 men on a conventional generator—took seven months, 700 men, all their available welders due to the danger of radiation, and a cost of one million dollars. During these seven months, the generator was "down", as is said in parlance.

Unpredicted dangers of the light water reactors are also outlined by Allan Hammond in "Fission: The Pro's and Con's of Nuclar Power" (*Science* magazine, October 13, 1972).

The liquid metal fast breeder reactor, as a substitute, also has some obvious unsolved problems which may make it impossible to use as an energy source.

The breeders will require something like 100 tons of plutonium, every year, by the year 2,000—this, according to Dr. Donald Geesaman of the Lawrence Livermore Laboratories in California.

Plutonium, as you know, is the fuel of the H bomb.

The housekeeping record of the Atomic Energy Commission, when it comes to plutonium, has not been good. Certain shipments, destined for a given city, ended up elsewhere. Losses have gone unaccounted for. Plutonium is such a volatile source of power that many people have grave doubts about breeder development for the simple reason that it would increase the availability of (and mistakes with) this substance.

What's more, plutonium wastes have a half-life of 24,000 years. This means that we would be passing along the responsibility for monitoring these wastes for thousands of years.

As reported in the *Times* (June 13, 1973), the U.S. Court of Appeals at Washington, D.C., handed down a unanimous decision to delay indefinitely the development of a Liquid Metal Fast Breeder Reactor until fundamental questions about environmental hazards are satisfactorily answered. On both a time and performance basis, this dramatized the uncertainties tied into our future dependence on atomic energy.

It is true that many prominent physicists are urging that fusion reactors receive highest research priority. In spite of the formidable technical problems, these advocates believe that a working prototype can be produced by the end of the century. Fusion, in their view, would represent an almost limitless, non-polluting source of energy.

So we have the breeder reactor, based on fission, producing more energy than it consumes—a tempting objective bogged down (some say fortunately) in environmental concerns. And fusion, simulating the hydrogen furnace of our sun and other stars—also tempting, but bogged down by anemic research budgets.

Lack of research commitment may also imperil other energy options. Solar generation and geothermal power, for example. But assuming that a financial commitment were forthcoming, and granting there are more efficient techniques for the generation and transmission of power, there would still be a ten-year lead time *after* the commitment was made before technological shifts could occur, at least ten years before implementation could begin on a significant scale.

"The energy joyride is over," as *Fortune* magazine put it.

Given the governmental and social context of the crisis, it seems clear than no technical solution can begin to reverse this worsening situation for two to three decades.

The most optimistic projection for such new, abundant and non-polluting sources—fusion and solar energy, especially—look to the mid-1980's for solar plant prototypes, and to the mid-1990's for fusion, *if* the technical problems can be overcome. The actual shift from fossil fuel to these other sources will take many years more.

It is fine and well to advocate pushing ahead the cut-off point for fossil fuels or, in contrast, advocate moving back the pick-up point for fusion or solar generation. Either argument leads us back to the point where we must question our energy demands, even scrutinize them—back to the point where we must ask ourselves what is necessary, what is desirable. This is particularly so when one faces up to the consequences of unbridled increases in energy production, be it fossil (as some say it should be) or fusion (as some say it should be).

Questioning Demand Projections

At present, trend curves generate projections.

One such curve has indicated that there has been a doubling of electric energy use every ten years, and projects it exponentially for the next couple decades.

On this basis, meaning the 20-projection, all projected oil exploration, all the needs of the power companies, the urgency of off-shore drilling, the desire to get rid of environmental constraints of power plant siting, *all* are justified in order to reach production goals in 20 years.

The utility and fuel companies have made very successful pleas. A statement by Mr. John McLean, head of Continental Oil, comes to mind, one he made before Congress, another in the press. Mr. McLean had four major points: Get rid of environmental constraints; get rid of restrictions on the well-head price of gas; increase authorization for off-shore oil exploration; get rid of import limits on oil from the Middle East and other foreign markets.

Mr. McLean assured everyone that there would be no more energy crisis if his points were acted on, that everyone would be able to count on limitless energy, just as *they always had.*

One of the reasons for such urgency on the part of energy producers is their assumption that the rate of demand is going to keep increasing. Plans (and pleas) to satisfy this projection are being made *now*. Repeat, *now*. But once such facilities are provided, it will not be economical to let them remain idle, and the projected demand will be realized.

An analogy in America's downtown areas will serve—the parking garage of the 1950's and 1960's. You remember, every block had to have one. The more garages we built, the more cars that came into the cities; and the more cars, the more garages. If you stand at the top of the taller buildings in some business districts today, you can see the red ink at the bottom of the audit sheet—the sheet is of asphalt, littered with cars. In this familiar case, projected demand became a death-knell for more than a few downtowns.

With respect to energy, it should be stated right off that exponential projections need not be inevitable.

Many long-range projections have not panned out. Population patterns have not followed the dire predictions of demographers. A decade ago, the average predicted family size was 2.6 children. A recent projection for the U. S. reduces this to 2.2. 2.1 children per family, considering infant mortality and other factors, is used as a basis for stable population—that is, a zero growth situation.

One aspect of this has a direct relation to architectural attitudes and responsibilities. In the last 20 years, electrical production has quadrupled and total energy use has tripled. In the same time, population has increased only by a third.

What accounts for the difference? Well, perhaps a change in the materials we build with. There is greater dependence on plastics and synthetics—all produced at a higher energy cost than the materials they replace. Then there is our growing dependence on mechanical control of internal conditions—heating, cooling, lighting, ventilating—instead of exploiting the external conditions endowed by nature when those conditions are congenial. There are also heightened performance requirements to consider.

The rationale for the intensified use of energy is that it enhances our working or living environment. But considering the dynamics of urban growth, those having profound effect in many parts of the world, we must ask whether the increase in energy per capita has resulted in a comparable increase in the quality of life per capita. In most cases, the answer is no.

As we get into this line of thinking a little more, I hope it will become clear that there is no effort to "hunt down" any one source of blame for the imbalance we have been discussing. All industries, all consumers, have "vested interests" in one way or another. And all of us, to a greater or lesser degree, have helped create this imbalance. It is only human nature to get a little touchy when someone like me starts to ask unsettling questions. Actually, events themselves are asking the questions. Pieced together over the last 20 years or so, they create a pattern of life in which our satisfaction with "the way things are going" was, to say the least, deceptive. And every segment of society, those producing energy as well as those consuming it, must be prepared (even willing) to have the sediment of such false satisfaction stirred up.

It is not a particularly stirring revelation, but our cities *are* worse, not better than they were. Housing, on both a percentage and absolute basis, has deteriorated. The quality of non-subsidized housing for lower middle income families has worsened sharply, having been supplied in large part by mobile homes—less space, less amenity, greater energy use per square foot, more rapid rate of deterioration. There has been no dramatic increase in square feet per person when it comes to residential space; or, on the average, when it comes to commercial and industrial space. Square feet per pupil in schools is roughly comparable to what it was.

Urban change has resulted in under-used schools in some areas, and vast acreage of new schools in others. With five million people being added to our population yearly, we build about 820 sq. ft. for each one; and, at the same time, we demolish, abandon, or lose by natural and man-made catastrophe about 220 sq. ft.

With the amount of space per person not significantly greater, and with the performance of existing space not significantly upgraded, the electrical energy use has not kept pace with population—rather, as pointed out, it has quadrupled in 20 years.

Where is it all going?

Some of it, to satisfy artificial needs, is quite literally going up in smoke. In less than 30 years vastly increased inputs of mechanical energy have replaced human labor. Techniques of assembly discourage repair, and objects have been thrown away when a small part failed. A relatively large investment of material and energy is then required to replace the discarded object, all with little or no improvement in the quality of life. We buy new furniture, clothing and appliances rather than have old ones repaired—if, in fact, we can find someone to repair them.

The same general situation has prevailed in building. It is often more economical for a speculator to tear down an old (even historic) building, one still perfectly sound (even leased), than to renovate it. Real estate values—based on maximum profit from maximum rentable floor area—encourage the premature demolition of many sound, useful structures. This not only intensifies the energy imbalance with respect to power, it has disrupted another kind of energy—the care which people tend to give a city of character, of diverse style and scale.

As a society, we have become culturally preoccupied with fashion. We throw away usable items because they are "out of style." A so-called new building commands higher rents than an old one—this, even though there are signs around the country that public awareness is swinging in the direction of adapting old buildings for new purposes. Even so, the preoccupation with fashion persists, and it is a vital part of our growth-oriented economy.

Style

There is an appropriate, precise relationship between form and the controls that produce it. This relationship is an important thread running through and interweaving all cultures. Such controls include materials at hand, technical knowledge, verbal development and social pattern. The highest achievements in culture pertain to the effective orchestration of such controls. At any time when an inordinate use of any control occurred, thus exceeding what the end product required for realization, the quality of that end product suffered as a cultural and artistic manifestation.

Most of the architecture of the last 20 years would, in this view, be absent. There has been a disconnection between our recent work and that of the great historic periods. Not only in architecture but also in transportation, politics, warfare, economics, rock music, writing and speech—overwhelming means (including energy) have been used to achieve simple, often mediocre ends.

The correlation with excessive energy use is obvious. For it produces an architecture that

Charlie Chaplin.

An Atala 10-speed racing bike.

Trulli, Alberobello, Italy.

not only is uneconomical to use but also one that seldom delights us with suitable setting, or competent execution.

Another contributing factor to what I have called an artificial energy demand is a problem found by the utility companies—one called "filling in the troughs." Such companies contend there is nothing worse than a utilization curve which peaks and troughs. When troughs occur (or are anticipated), the utilities try to find uses to fill them in, thus better insuring a maximum return from their capital plant.

Fine. We understand their position.

But whether you burn fuel for electricity at nine o'clock or at three, whether you burn it in June or December, that fuel is still *gone*. All of which gets at a fairly simple point: If we have become a wasteful culture it is because it has been profitable to be wasteful.

My office has been interested in this point for some years because it affects (or should affect) design. In the last year or two, it has become clear that it is an acute problem — for everyone. We prepared a paper outlining the ways in which the architectural profession uses energy in designing a building, and of the ways in which the buildings use energy after they are designed; that is, actual operation and maintenance.

We found that for every million dollars worth of building, about 1,250,000 kilowatt hours of energy went into the materials that went into the building. We also found that for every year the building was in operation, it required about a million kilowatt hours of energy for operation and maintenance which went into heating, cooling, ventilating and vertical transportation.

Looking into individual components, we found that all were seriously in excess of what was necessary to perform their respective tasks. Some of this excess was due to design, some to our wasteful habits.

Finally, we found there could be significant energy savings. Making a conservative estimate, we figure that savings could be as much as 25 percent of all the electrical energy sold in the United States. That is the equivalent of some 50 1,000-megawatt generating plants.

Other Effects of Energy Use

Before going into questions about specific areas of energy use, there are other problems related to the burgeoning use of energy, especially electric energy.

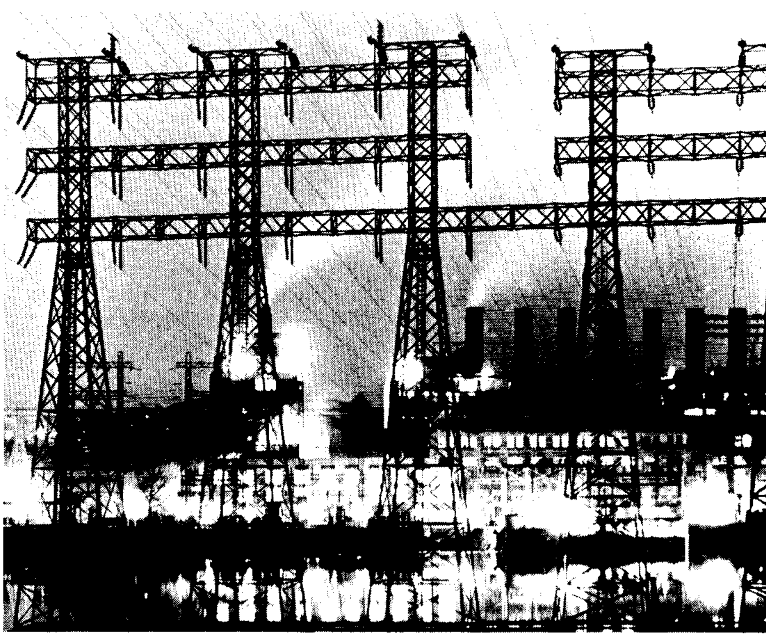
I suppose you have heard this before, but there is an environmental cost attached to all such use. The greater the use, the greater the cost. As use increases, costs increase more rapidly since greater demand is met by taking greater chances. More tankers, new ports, mean oil spills—even with that industry's much-touted precautions. More coal means strip mining. More fuel consumption means exploiting less productive oil fields in an effort, so the saying goes, to scrape the bottom of the barrel. Greater dependence on nuclear generators results in the industry's urging less stringent safety and environmental controls—and in their dismissing such concerns as "alarmist."

All fuel and electricity production creates some pollution and environmental damage. Even hydro-electric dams require flooding thousands of acres in the impounded areas. In time, these silt up, becoming less useful. Burning of fossil fuels for electricity releases particulates and chemicals which lessen air quality—sulfur dioxide, nitrogen oxides, carbon monoxide, carbon dioxide. In New York, for example, the concentration of generators along the East River has been nicknamed Asthma Alley. At the Four Corners, where New Mexico, Colorado, Utah and Arizona meet, coal burning generators have made the area's once-clear atmosphere filthy—this, to produce electricity for California.

Thermal pollution is another result of the generation process —the heating of the atmosphere or the cooling of water near the plant to dissipate the waste heat from the generators. The problem becomes particularly acute with nuclear plants where the differential between the heat in the reactors and the safe temperature for the operation of the plant requires a large cooling capacity.

In the New York area the cooling cycles for the small Indian Point One generator (254 megawatts), and for the larger Indian Point Two (operating well below its 1,000-megawatt capacity) have resulted in extensive, unacceptable fish kills. In seeking sites for nuclear plants in Rhode Island, a research team has concluded that no site on Narragansett Bay would be satisfactory because of thermal change in the water.* Some danger also is present in low level radiation leakage—this is in addition to the unresolved question of a major accident resulting from malfunction or sabotage. The ultimate environmental damage resulting from a failure in the containers for radioactive waste has been suggested by some nuclear physicists. No increase in energy production is without its environmental quality costs.

The transmission of electricity has to be reckoned with. In spite of pressures for an underground transmission system, cost and flexibility of expansion have resulted in most projections being based on overhead power distribution. While a cryogenic underground system with near-zero voltage drops has been proposed, there seems to be no follow-up effort. Based on present distribution methods, a projection has been made that by 1990 the area required for transmission rights-of-way will be equal to the area of the State of Connecticut.** This minimizes the effect on the visual environment, however. While a right-of-way may be 500 feet across, the towers and lines dominate and dwarf the land for a half mile or more on either side.



Electric transmission towers, Springdale, Pa.

The impact of oil refineries, too, is both visually domineering and also unacceptable in its introduction of *pollutants into* the atmosphere that assail eyes, nose and throat. While discharges have been cleaned up somewhat in newer refineries, a non-polluting plant has yet to be produced. There is a good deal of information on the changing and non-biodegradable nature of the pollutants that are now being introduced into the atmosphere. To understand the problem in its true seriousness, Dr. Barry Commoner's *The Closing Circle* is essential reading.

Until recently, everything we have done has been within the capabilities of our eco-system to undo. A stream could be expected to purify itself a short distance down from the point of sewage discharge. Smoke particles in the air could be expected to blanket a limited area down wind, a pattern that caused town planners as recently as 35 years ago to designate industrial sites on the lee side of town, with an unoccupied zone beyond. Changes both in the scale and nature of our technology have changed this pattern.

Continuing on our present path is foolhardy. Any fuel

*pp. 41 & 42—"Future Electrical Energy Requirements and Power Plant Sites for the State of Rhode Island," by Brown, Rose, Bartlett, et. al., University of Rhode Island.

**Toward a Rational Power Policy. New York City Environmental Protection Administration, April 1971, p. 64.

burned for electricity produces heat and particulate pollution where it is burned, in one form or another, and also produces additional heat pollution where it is used. The conversion of electricity to useful work is not a completely efficient procedure and heat is released.

The nature of cities has also created tremendous changes in weather formations. The whole New York metropolitan area has a substantially changed weather pattern due to several things—one is the tremendous increase in combustion and energy use. Second is the tremendous increase in paved and heat-retaining surfaces. Third is the release of great quantities of moisture in certain areas of the central cities as a result of the omnipresent air-conditioning systems. The traditionally predictable weather patterns have changed.

In New York City 25 years ago it was possible to expect a very significant difference between day and night temperatures and reversal of ocean winds since New York is a seaport city. This would to a great extent relieve the heat problem that had been produced during the day. But dependence on cooling night breezes no longer exists, not only in New York City but for a distance of some 40 miles out on Long Island.

I was impressed to learn from the Director of the National Atmospheric Research Center in Boulder how little it takes to change weather patterns substantially. He related that one subsonic plane flying over the Gulf of Alaska for one day can create a complete cloud cover of cirrus clouds that will persist for ten days, carried by the jet stream as the weather front shifts across the Arctic Circle. A weather pattern of that sort, sustained for a number of days, can shorten the farming season in northern areas. So weather changes are an important secondary result of growing energy use, even though such atmospheric events do not exactly preoccupy our day's thinking.

As energy use has increased, and the devices to control visible pollution have become more sophisticated, city areas affected by combustion have increased. While turbidity in the cities is not as bad as it was, smaller particles stay in the air longer, until today we can find 200- to 300-mile nucleated cloud plumes originating in New York and Philadelphia. Urban pollution has shifted to global pollution.

The reflectivity of the earth's surface has also changed. Oil slicks cover large areas in the oceans, changing evaporation patterns. 30 percent of the Bosnywash area is now paved or roofed, with the resulting change in reflectivity and water runoff.

U.S. vs. the World

We tend to think of the dimensions of energy use as a United States dilemma. When the world context is reestablished, the gravity of the situation becomes more apparent. There is a widely quoted figure: That the U.S., with six percent of the world's population, uses 35 percent of its energy and resources: in other words, almost ten times the energy use per capita as in the rest of the world combined.

The following figures, correlated with Gross National Product per capita, compare the energy use per capita of the United States (1969) with that of various other countries.

Countries	Million Btu per capita*
United States	300.00
Sweden	165.00
USSR	120.00
Finland	102.00
France	101.00
Japan	81.00
New Zealand	76.00
India	5.50
El Salvador	4.50
Pakistan	2.13
Ethiopia	.67

Although this can be a misleading index due to the difficulty of equating dollars with goods and services produced in other countries, there is no doubt that countries at an early industrial stage will expect rapid growth in their use of energy. Among these are China, India, Indonesia, countries in Latin and South America, and most of the countries in Africa. The countries that already have an advanced economy will expect to enlarge their energy use. These include Japan, Western Europe, Russia, Eastern Europe and such countries as Australia and Brazil. Their rate of growth will be rapid, and they will be in world competition for petroleum and natural gas.

Some interesting figures were cited by a Japanese economist at an energy workshop. Japan, which has serious power and pollution problems, imports most of its petroleum: 90 percent from the Middle East, five percent from Indonesia and five percent from the Soviet Union. All told, they use some 200 million tons a year. They project a growth of energy use in the next 15 years that will raise this to 500 million tons a year. Because of nearly intolerable air pollution levels, they are seeking low-sulphur petroleum or natural gas. The economist said he had been in conference shortly before with some high Chinese officials. China now produces 20 million tons, but they projected a need for 200 million tons by 1980. And they estimated that if China were to consume as much per capita as Japan does now, they would require *two billion* tons a year.

This was not put forward as a working proposal, but merely to describe one consideration in making world wide projections. Obviously they, as well as other countries with expanding needs, will challenge the United States in the world arena.

Aside from the obvious security problems in our competition for energy in the world market, we will find ourselves in an increasingly untenable moral position, if our increasing demands prevent resolution of fundamental problems in other parts of the world.

If the estimates of energy sources and material availability are given any credence at all, we had better make immediate adjustments in our philosophy, our priorities and our aesthetics. The short life of the French Queen, who said "Let them eat cake"' as an answer to the starvation around her, should be a warning to us.

While energy-hungry countries are looking to atomic energy to supply an increasing percentage of their needs, this is not a significant factor for the next couple decades. For the United States, there is a projection of possibly 20 percent of power generation by 1985 being supplied by nuclear generators. This, however, is only about five percent of all its energy needs. As local resistance grows to locating nuclear plants, fossil fuel use will have more than doubled.

The heart of the problem still rests with the burgeoning demand figures we have saddled ourselves with, and the limited, diminishing supply of fossil fuel.

Architectural Aspects

Architecture, embracing the entire built environment, is responsible for over a third of all energy use in the U.S. If we are genuinely concerned with understanding and possibly modifying this, we should have a detailed understanding of how we use and commit energy through our buildings.

1970 figures indicate we are using 69,000 trillion Btu's of energy. About one quarter is used for electricity. The balance is in various direct uses, mostly in some form of fossil fuel. Electricity loses a significant amount of the energy necessary to produce it in the generation process. For example, the number of Btu's necessary to generate a kilowatt hour of electricity varies according to the efficiency of the generating equipment and the kind of generator—steam turbine, gas turbine, etc.—from about 10,000 Btu's to over 13,000. A kwhr (kilowatt hours, one thousand watts delivered for an hour) has a theoretical heat content of 3,413 Btu's. After the loss in generation, there is a further loss in transmission of another ten percent or so as the power adjusts from higher to lower voltages. This efficiency loss does not occur in hydro-electric generators, but does occur in nuclear and geothermal generation where steam is used to operate turbines.

Methods reporting electrical use make it difficult to know precisely how it is divided among various users. In national reporting by the Edison Electrical Institute, for example, all residential is grouped together regardless of unit size —single family, multi-family, etc. Small commercial and industrial is linked in a single category as is large commercial and industrial.There is no precise designation of use by commercial office buildings for ex-

**1971 Statistical Abstract U.S. Department of Commerce figures in lbs. of Coal converted to Btu: Average figure from "Report on Investigation of Electric Power Supply and its Effect on Air and Thermal Pollution in the City of New York," 1971. A Btu, or British thermal unit, is the amount of heat necessary to raise one pound of water one degree Fahrenheit.*

ample. And yet in New York City, more than half of Consolidated Edison's load is attributed to commercial customers. Transportation is a separate category. Other uses are lumped under miscellaneous. This, in a time of technical precision?

The electricity produced is part of the total energy in these various categories, and forms part of the supply required in manufacturing aluminum, electric steel furnaces, electric kilns and so forth. It is included in transportation for some trains, electric bus systems, subways and similar uses. For total energy used, electricity must be added to energy in other forms.

Of the other major categories in energy reporting, transportation requires 25 percent. Industry for process purposes requires 41 percent. Fossil fuel heating and cooling of buildings require about 20 percent. (E. Hirst and R. Herendeen, "A Diet Guide for Chronic Energy Consumption," p. 64FF—Saturday Review, 28 Oct. 1972.)

To understand the extent of energy use in and through buildings, the following rough percentages are helpful. Of the total Gross National Product, about ten percent is in the building construction industry. In the building process itself, energy uses amount to 22 percent of the electricity used by industry and about 7.5 percent of all electricity.

Of the 25 percent of all energy that electricity represents, about one half is for devices built into the buildings—the lighting systems, the ventilation systems, the air-conditioning, pumps, motors, elevators, escalators, and the electric heating systems. Going back to primary sources, this represents an additional 12 percent. And in the direct fossil fuel use for space heating and cooling, and for what is called process heating (the heating of hot water), there is another 20 percent.

This adds up to about 40 percent of *all* energy use.

Moreover, there is a certain amount of energy use for transportation that can be traced back to achitectural and planning decisions about building groups—neighborhoods, towns, cities, regions.

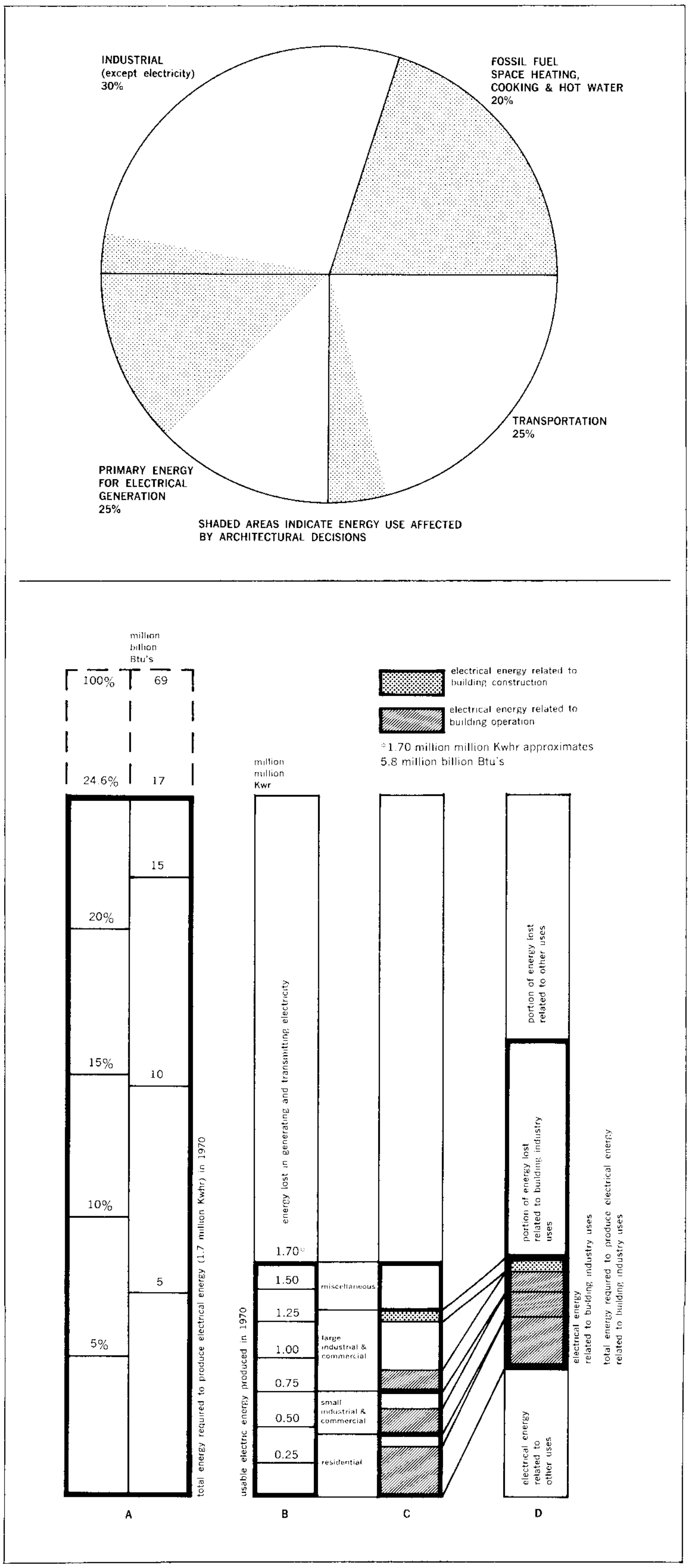
Another area of energy use that is difficult to quantify has to do with demolition. We have unfilled needs nationally, in regard to housing, schools, hospitals, cultural facilities, and other buildings. How does one evaluate the decision to replace a building with a useful anticipated life with one serving the same or another purpose, especially when the decision will require an energy commitment to demolish and dispose of the one building, an energy commitment to build its replacement and in some cases, a higher consumption of energy in maintaining the new space?

Going from percentages to actual quantities, we see the magnitude of use and the potential benefits of less use.

This diagram (top) gives some indication of total energy use and the part of it that is consumed for electricity and, in turn, the part of that electricity used or committed through the architectural process. The figures given are for 1970. Below left, you will notice a bar graph that shows all energy used in the United States that year, for whatever reason—transportation, manufacture, illumination. We have not indicated what the sources of the various energy uses are but they include fossil fuel, hydro-electric and nuclear energy. Of the energy consumed, the total amount recorded in Btu's is 69 million billion. 17 million billion of these, or about 25 percent, are used for production of electrical energy and these 17 million billion Btu's produce 1.7 million million kwh's. In the course of producing those, there is a good deal of that energy, in fact about two-thirds of it, which is lost in the generation process, so that the amount of electrical energy produced is roughly the equivalent of 5.8 million billion Btu's (diagram bottom).

All the energy used in buildings is used wastefully. Lighting, the most obvious and visible use of electricity, represents about 25 percent of all electricity that is sold. In office buildings, lighting represents over 50 percent of the energy used. It is also a high energy user in schools—sometimes as high as 65 percent.

Incredibly, when the importance of efficient energy use is considered in terms of its ecological, social and political impact, it is hard to realize how we can persist in the wasteful practices we now find around us. According to *American School and University* (February 1973) the median expenditure per pupil in 1972-73 is $1,046. Electricity, oil and gas represent $20.88, just over two percent. Yet, in terms of energy use, educational facilities in 1970 represented seven percent of all construction put in place (*Statistical Abstracts* 1971, and can be assumed to use almost a proportionate part of energy, about six percent of the energy used by buildings.



In a year, we build about 165 million square feet of educational facilities. Each square foot will consume, on the average, about 15 kwh's a year. A saving of 50 percent would be a saving of about 1,000 million kwhr's a year. In ten years, this would be 10,000 million. Stated in other terms, it would be the complete electric budget for two million families, or it would be the generating capacity to take care of all the needs of 20 Schenectadys, or it would be adequate for the residential requirements of New Mexico eight times over.

The typical non-electric energy load is of the order of 100,000 Btu's per square foot. A 20 percent reduction in new school buildings would produce a savings of almost 345 billion Btu's per year; or again, in a decade, almost three and a half trillion Btu's.

Energy Curve For Buildings

Every building can be considered an activity resulting in energy use throughout its life. The energy curve can be generalized, or it can be graphed, with all the variations that describe a cold winter, the installation of a new piece of equipment, an alteration that would change lighting levels. Characteristically, though the curve would respond to the energy used in building, the energy required to operate, maintain and, finally, demolish the building would all be graphed on a continuous time scale (diagram, below).

Building materials and the construction process can be averaged as a straight line through the construction period. (This is an approximation since the energy required by products and their components can be expended in a time period unrelated to the period of building.) After the building is in use and through its life, the energy use can be described by an undulating curve which may have a high peak in midsummer and a lesser peak in midwinter with troughs at spring and fall. The line is composed of a series of daily peaks and troughs, with peaks during the afternoon in winter and at midday in summer. The whole undulating line climbs slowly, year by year, as equipment and assemblies become less efficient and as energy is used in replacements. It has a momentary peak at demolition, then drops to zero.

Considering building and average maintenance costs for high rise commercial buildings, as a broad generalization, for every million dollars of new building, there is now an electrical energy expenditure of 1.28 million kwhr. To operate and maintain that million dollars worth of building on an all electric basis one million kwhr per year are required, rising to 1.13 million kwhr per year as maintenance requirements increase.

There are tremendous variations in individual buildings, both in construction requirements and in operation costs. Dr. Charles Lawrence, Public Utilities specialist for New York City, conducted a survey of over 80 commercial office buildings built after World War II and found variations of seven to one at the high and low extremes of energy use per square foot for buildings serving similar purposes. While this makes it necessary to be cautious about statistical generalizations, individual studies verify the susceptibility of all these installations to significant savings.

Also, if a national energy reporting system were set up, the summation of the annual energy use in all buildings—new ones under construction, buildings being operated and maintained, buildings being demolished and materials being extracted and processed for building — would add up to the total we have approximated from other sources and would give an energy profile for the year, showing how this use varied daily and seasonally.

Observation

Of all the appliances, artifacts and objects made to serve our daily needs, a work of architecture is among the longest-lived—longer than appliances, vehicles or the machines for business and manufacture. Where an automobile may last from five to ten years and a television set even less, the life of a building may well be more than half a century and the infrastructure, the streets and utilities, last for hundreds of years. You can still go to Italy and travel on the Appian Way, a road that is 2,000 years old.

The importance of this, of course, is that the architectural decision—the openings in a building wall, the width of the building, the orientation—establishes a pattern of energy use that is carried forward for decades. If there is a change in taste, legislation or gasoline availability within ten years or less, requiring a shift from 400 to 100 horsepower cars, there can be a virtually complete replacement of the entire stock of automobiles. If, on the other hand, the same attitudes questioned the sealed glass building, they would continue as an important portion of our urban life.

The Tall Building

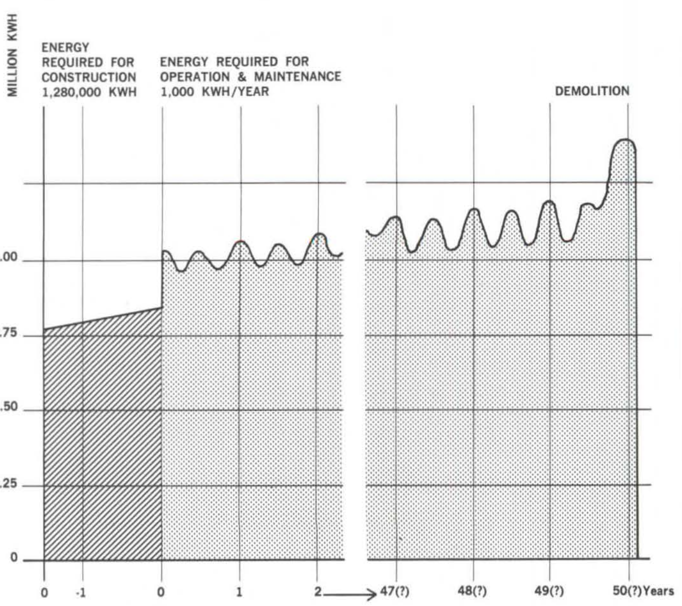
The tall building, particularly the tall, glass-faced, sealed commercial building, has become an identifiable building type, with standard equipment, catalogue components and design methodology. Since it has become a significant energy user in the service areas of most utility systems, it merits close analysis.

Its form results from the economics of real estate in central urban areas. In order to speed design, it seeks to avoid rather than exploit individualization of use, site and orientation. While there is a psychological groping by individuals to preserve their uniqueness, there is a continuing drive toward the further generalization of our world by building in the patterns that have been established in the last two decades.

For example, the large commercial building has become a typical sealed volume. It doesn't matter whether it is the World Trade Center in New York, which is still not completed, or the Chase Manhattan Building, completed 15 years earlier. Both disregard orientation and depend on massive use of mechanical cooling to compensate for the heat gain on the outside from sun and on the inside from lights and body heat. In the World Trade Center most of the area is interior space. The perimeter from the inside is a nervous alternation of slots and blank walls. The people working there have no individual choice about turning lights on and off. Since many of the interesting old restaurants in the area were demolished to make way for the new construction, not even the quality of urban eating has been enhanced in this "bargain."

Dr. Lawrence, in his study of energy use in the 80 post-World War II buildings, noted that it was characteristic that, decade by decade, energy use per square foot has been increasing, although the performance of the buildings, the services rendered for the tenants, has been largely unchanged. The average building in the more recent period has been larger, requiring more expensive and higher performance elevators. The light levels have been higher. There is more interior space requiring lighting and cooling more of the time. More money has gone into high level lobby lighting and facade lighting.

But in all this, the quality of life for the people who work in the building has not been improved. There is greater monotony, less individualization and greater disconnection between the environment people work in and the factors creating or influencing that environment. The sense of identity, of personal



CHARACTERISTIC ENERGY UTILIZATION CURVE (MILLION KWH/MILLION $ OF BUILDING/YEAR) worth is diminished in the ambiance provided. It is not surprising that there has been such a disillusionment among white collar workers.

New York City alone has built 67 million sq. ft. of offices in the last 20 years and projects an additional 68 million in the next ten. The two towers of the World Trade Center require as much electrical generating capacity, about 80,000 kilowatts, as the entire city of Schenectady, a city of 100,000.

Since somewhere over 15 times this square footage is projected for New York City in the next ten years, it is worth seeing how this energy is used. With the help of Peter Flack, my office studied a hypothetical million square foot building with a typical configuration and used typical factors to see what both the demands and consumption of electricity might be. If we assume that something other than electricity is used for heating and for air-conditioning, the division in electrical uses is roughly as follows: Lighting is about 54 percent, advertising, display and merchandise lighting about seven percent, elevators about eleven percent, fans and air-handling equipment about 10 percent, pumps and motors about five percent and miscellaneous uses including office machines about 13 percent. The light levels can be considerably reduced both by computing the light loads according to more realistic light levels and by allowing for more specific localized variations. More selective switching can result in a substantial savings in electric use. The perimeter lighting that takes care of the outer ten feet of the building could be switched separately in response to outside light levels. This in itself would save about 25 percent of the original light level. In addition, it would result in about a ten percent reduction in the air-conditioned load. All told, there could be a 50 percent reduction in this item of light use.

Ventilation according to some codes is based on three air changes an hour, a magical determination that nobody that I have asked so far has been able to justify for any physiological or performance reason. Conflicting codes, non-ventilated buildings with windows that are never opened and fan systems that may remain unused by maintenance personnel suggest that this figure be looked at critically. If the outside wall of the building were not sealed, outside air at a temperature sufficiently close to the temperature required could be introduced, with neither heating or cooling, for about 500 of the 3,100 hours of annual building use.

While advertising is completely dispensable, it need not be if attitudes toward light levels in advertising and merchandising were revised. The present tendency is to depend entirely on maximum light impact rather than on how light is used and what the message of the light is. If mandatory ceilings were placed on light levels for advertising and merchandising, the nature and also the effectiveness of advertising would be significantly upgraded.

There are many special factors that can dramatically change actual energy use, such as the operating temperatures for both heating and cooling. Lockheed was reported by *The New York Times* (June 3, 1973) to have raised the temperature to be provided by air conditioning from 72 to 75 degrees with a resultant saving of $100,000 million a year. That could buy 50 million kwhr of electricity. Heat reclamation devices (heat recovery wheels, for example) can capture heat that would otherwise be dumped outside for winter ventilation, or the cooled air in summer. Higher performance skins, control against summer solar gains, more selective thermal and light controls, avoidance of such wasteful practices as terminal reheat, and more efficient equipment are among the available options.

The question of energy savings for elevators raises more complicated problems. Lower buildings not requiring vertical transportation have greater surface area with attendant increases in heating and cooling loads. These can more than offset the saving gained by eliminating elevators. Moreover, lower buildings cannot be as well served by mass transportation and may require the extensive use of private automobiles. On the other hand, the super highrise buildings are more a product of high land values than of their own inner logic. To oversimplify the reason, in creating a 100-story building, you cannot simply place one 50-story building on top of another. The great bank of elevators that serve the top 50 must be brought down inside the bottom building and alongside its elevators. Similarly, all its services and pipe systems take up a large amount of expensive space, merely to get where they are needed. Whereas a 50-story building has a roof area (with its heat loss) of two percent of its floor area, a similar floor area in three-story buildings requires a roof area of 33 percent. The difference between a 50 and 100-story building, however, is only the difference between one percent and two percent.

A Look At Structure

There has been a great national effort to recycle cans, papers and bottles. Certainly the energy saved is appreciable. The total annual energy used in making beer and soft drink containers is .34 percent of the nation's total energy expenditure. By way of comparison, the major metal that goes into the building industry consumes around one and a half percent.

There is no doubt that our structures contain more material than stability and safety require. Almost every structural component is manufactured in a uniform linear manner—steel beams, timber, lally columns, prestressed concrete beams, roof planking, steel decking. Yet all these are subject to varying stresses throughout their lengths. Concrete is crudely placed to eliminate the complexity of formwork and steel placement that responds to varying load. The underestimation of the structural contribution of materials that are incorporated into a structure for other than structural reasons could reduce ma-

Observation

While there is a growing body of data relating to energy use within highrise buildings, there is a dearth of information about the indirect energy demands resulting from them. Since overall energy efficiency will become an increasingly important component of urban planning decisions, some speculation is in order. At least until hard data have been collected.

Aside from the cultural advantages of cities — museums, schools, theaters, concerts, variety of choice, the tolerance of the non-typical—there are at least, up to certain density, also advantages of economics and energy use. Certain things that are done individually in rural areas, such as water supplies and sewage systems, or with extended branches for electrical distribution, roads and infrastructure installations are reduced as buildings are grouped and as density increases. Energy use per capita also can be reduced up to the point where the vascular systems become so crowded, and the available land where systems originate so remote, that each new building cluster, intensifying an already dense area, requires a complete revamping of all service systems.

For example, what is the true cost, both in economic and energy terms, for the projected increases in density for downtown New York? The environmental impact of more power generation has already made it dubious that generating facilities can be built within 35 miles of the load centers. Even a site 35 miles away, Indian Point on the Hudson River, has been held up because of unsatisfactory handling of waste heat. The proposed Storm King pumped storage facility, 15 miles further, has also been delayed by unresolved environmental problems, in addition to its basic inefficiency in converting primary energy into electricity. In order to meet projected electric needs, Con Edison is using newly installed gas turbines, originally intended as peaking units (that is, reserve units that operate only when there are peak requirements) but now used more and more frequently for base load. They have contracted to buy power from Quebec Hydro. They got past a recent hot day, June 11th, with only an eight percent power cut and local outages in Westchester County by calling on power companies from Maine to Washington. The cost of installing the networks and the premiums for purchased power ought certainly be attributed to the new construction instead of being prorated across the entire system. In addition, new power lines have to be installed from the generating stations through the clogged arteries of city streets to handle the new load.

At the same time, similar problems have to be faced and overcome for the water systems, the sewage systems, the solid waste disposal systems and of course the transportation and service delivery systems. The strains on all of these, and the disruption and reconstruction of streets and parks, suggest that we have already passed the point of diminishing return.

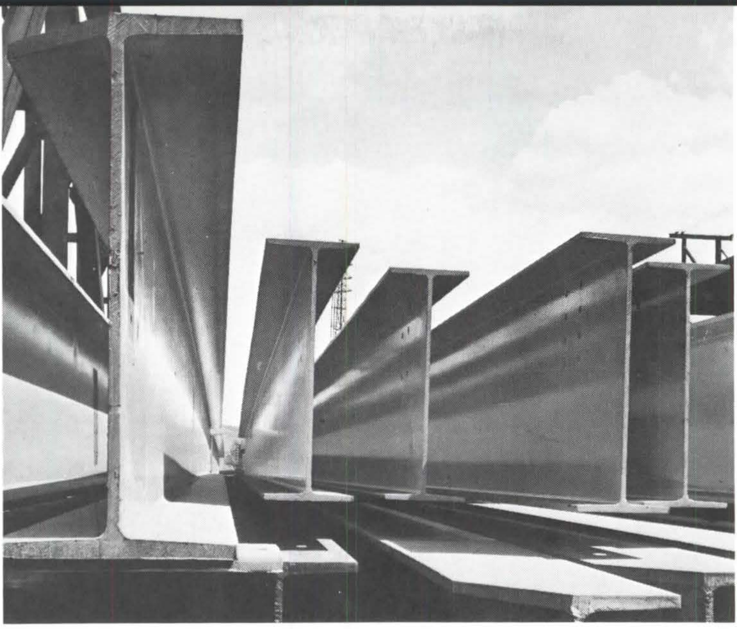
By breaking apart the organism at a certain density, it is possible *to create* more balanced systems, where the efficiency increases, resulting heat reclaimed from electric generation for heating and cooling, offsets the lesser efficiency of operating more smaller plants. Since one of the consequences of increasing density may be a major long-term commitment to significantly higher energy use, a study to correlate various densities and their energy requirements is urgently needed.

terials further—concrete fireproofing on steel, floor fills, continuous hung lintels, steel stairs, wood finish floors, lath and plaster membranes. The work of engineers like Dr. Jacob Feld, based on building failure studies, offers interesting grounds for reinvestigating computational methods. More rigorous structural analysis, eventually revised theory and codes, plus components responding in their cross-sections to varying structural demands, will immediately allow substantial energy savings.

The most characteristic piece of steel that goes into a building, the steel beam, is used inefficiently. A steel beam has a sophisticated cross-section. Even within the limitations of rolling mill practice, it works reasonably well. In practice, a specific beam is selected to satisfy the worst loading condition of a span, the maximum bending moment, for example. At all other points of the span it is excessive. The result is a vast overuse of steel. In contrast we can look to those structures where weight is a critical element or where the scale is great enough to warrant more structurally responsive forms. The boom of a mobile crane is one example, the structural ribs on a ship another, a bridge structure another and an airplane or high performance car another.

Open web steel joists suggest the kind of vocabulary that could result in material and energy savings.

An example: Safety factors tend to pyramid, becoming unnecessarily high. Let us consider a simple concrete beam computation as an example. In figuring the loading, liveloads (that is, loads other than the weight of the structure) are assumed to be simultaneously applied over all rooms, corridors, lobbies and stairs. A 750-sq.-ft. classroom for 30 pupils is computed to withstand a load of 40 pounds on every square foot, or a total of 30,000 pounds in addition to the weight of the structure. Thirty large children and a teacher might weigh 5,000 pounds. Thirty-one desks and chairs might add another 3,000 pounds. Adding another 1,500 pounds for friends, books, paraphernalia and miscellany would bring it to 9,500 pounds, less than one third of the figure used in the computation. In addition,



Steel structural sections.

World War II Supermarine Spitfire, a plywood monocoque plane (above).

Racing car—a John Player Special, (below).

the values given for the concrete have a 300 percent safety factor and for steel a 50 percent factor. Further, the structural designer will select available steel for reinforcement and overall dimensions for his beam cross-section at the first size above the size required by the computation, adding another five percent. In mixing concrete, the concrete plant will provide concrete above the design figure in order to avoid its rejection at the job, not infrequently 10 percent to 20 percent above the concrete value designed for. On top of this, concrete continues to gain strength for years after it has been assumed to reach full design strength. And as a final safety factor, no structural credit is taken either for such things as applied cement finishes or the capability of the structure to resist loads in a much more complicated and unified manner than is encompassed in the original calculation. A further overuse of material comes from the American economic pressure to reduce labor time *even at the expense of more material.*

It is quite obvious that reducing safety factors would permit concrete to be designed safely with less than half the material now used. Any structural engineer will confirm this under several provisos. First, that building codes be rewritten. Second, that there be enough in the budget to pay for the labor that is necessary to build formwork carefully, place steel carefully and to mix and place concrete carefully.

In addition to the saving in the individual members, there is a further cumulative saving since the weight of the building itself is substantially reduced. The size of the footings and foundations can be considerably reduced, with further savings in material, reflecting both the more realistic structural analysis and the reduced loadings that the foundations and footings are designed to support.

We have computed that in cement production alone this could result in energy savings of about 20 thousand million kwhr's a year. To make a comparison, a generous electricity usage budget per family is in the range of 5,000 kwhr per year. *Thus, this savings alone* would provide the electric power for four million families.

Wood, too, is used excessively.

For years every member has been designed as though it were disconnected from the rest of the structure. Where concrete is at least deemed to operate as a T-beam, a floor joist is assumed to be unaffected by the sub-floor and floor attached to it or the ceiling membrane below it. First steps are being taken by the plywood manufacturers to see that structural credit can be taken for the assembled structure. Although savings within part of the building's energy curve are small in comparison with the energy savings possible in the operation phase, they are of consequence in themselves.

Lighting

Lighting is also coming in for serious reinvestigation, and for good reasons. Lighting represents about a quarter of all electricity sold; that is, as noted in the *EEI Statistical Handbook* 1970, about 500 billion kwhrs. 15 years ago, recommended light levels were as much as two thirds lower than present recommendations of the Illuminating Engineering Society (IES) in some categories. 15 years ago, only about one third of present quantities of electricity were being generated. In the interior of buildings, air conditioning is a more frequent requirement than heating. Every two excessive watts of lighting requires one excessive watt of cooling.

While the IES professes a primary interest in the quality rather than the quantity of light, all the quality related tests—Visual Comfort Probability, Equivalent Sphere Illumination, Effective Foot Candles—tend to downgrade the effectiveness of the light computed to satisfy the IES recommended minimal standards, making higher intensities inevitable if the entire methodology is embraced.

Spot analyses indicate that lighting can be reduced by large percentages. There is an advertisement of a lamp manufacturer in the IES magazine *Lighting Design and Application* (Nov. 1972, pp. 58-59). The heading reads, "Part of this lighting story is a lot of hot air." Across the top of the page is a picture of an office with a number of ceiling luminaires, people working below, a stretch of glass wall toward the right of the photo and a text that says, "Over 25,000 Sylvania Curvalume lamps light up the interior of S.S. Kresge Corporation's new headquarters in metropolitan Detroit. With two Curvalumes to a fixture, Kresge got the lighting they were after—and much more. The heat from the U-shaped lamps and ballasts is saved and recirculated into the building. It's a conservation of energy concept with Curvalume lamps at its heart. The bent lamps make it possible to use two by two foot fixtures that can be evenly spaced over the modular ceiling. This makes for even distribution of air as well as light. In Kresge's contemporary building, these long-lived fluorescents last even longer. They are never turned off, which lengthens their life. The constant circulation of air around them increases their efficiency. This handsome installation gives lighting levels of 100 footcandles or more in the general offices and the color of the lamps blends in beautifully with the interior decor."

Now let's see what they are really saying. If 25,000 40-watt lamps are in use 24 hours a day, there are one million watts in use for 8,760 hours a year; or in kilowatts, 8,760,000 kilowatt hours per year. If all the lamps are on from 8 a.m. to 6 p.m., that would mean there are 14 hours of unnecessary time for five days of the week. A million watts times 14 hours is 14,000 kilowatt hours per day times five days of the week, or 70,000 kilowatt hours. On the two days you do not need the lights on at all—that is 48 hours times one million watts, or 48,000 kilowatts. This means that there is an unnecessary expenditure of 118,000 kilowatt hours per week times 52 weeks a year which means that 6,136,000 kilowatt hours per year out of 8,760,000 kilowatt hours are unnecessary.

The waste, just in dollar terms, not to mention energy, at two cents per kilowatt hour, is $122,720 per year. As described, instead of using the tubes 2,500 hours per year they are used 8,760. More than three times what they should be. The ad states, "They're never turned off which lengthens their life."

Let's see what this means. If the lamp is turned off once in ten hours, according to the IES Handbook, it will last 140/190 times as many hours as one burning continuously; that is, 75 percent as many hours. If its lamp life is 10,000 hours (the figure given for medium loading) it would last four years if burned ten hours a day for five days a week. If it is on continuously with a life expectancy of 13,300 hours, the additional 25 percent lamp life, it will last about a year and a half. In other words, while the lamp lasts longer it has to be replaced almost three times as frequently.

It is interesting to see in the ad's photo that there are some 15 people at work in the section of the office covered in the photograph. The ceiling above them has 181 fixtures each with 80 watts without counting the power load for ballast, a total of 14,480 watts, or about a thousand watts per person. The lighting is distributed indiscriminately, or should we say uniformly, over banks of files, desks, corridors, storage spaces and aisles. There are 40 fixtures over a bank of files with one person filing.

Also there are floor to ceiling windows that would appear to throw a high level of light for a distance of three ceiling modules or about 15 feet from the window. Yet the lights there are continuously on. Obviously all this adds to the summertime heat load for air-conditioning as well as the power load that the lamps themselves consume.

Next, according to the text the basic light levels provided are above 100 footcandles. According to an article by Mr. Robert Dorsey, then President of The Illuminating Engineering Society, in the AIA Journal (June 1972), this is satisfactory for reading a fifth carbon, which requires ten times as much light as the original for equal visibility. And since lights are always left on, there is no provision for selective switching even if there were an attempt to cut down on energy use.

Let me recapitulate. If the lights were on for an average of ten hours a day, five days a week, this 8,760,000 kwhr load would be reduced to 2,624,000 kilowatts per year. If the maximum overhead level were 50 footcandles (which is higher than the 30 footcandles cited by Mr. Ringgold of IES as adequate for the reading of printed matter), if offices where interviews are carried on were lighted to 20 footcandles (both generous since every typist using an electric typewriter has a connection nearby that could also permit portable light in the typist's area), then the above figure could be reduced by 60 percent. If we add a five percent factor for local lighting, the saving would be 55 percent, reducing the overall power requirements to 1,062,720 kilowatt hours.

Selective switching could turn off unused sections of the office. Conservatively, another 10 percent could be saved. The reduced requirement is now 956,450 kilowatt hours. This total obviously permits a significant reduction in air-conditioning requirements. The capacity of the plant can be substantially reduced and the operation will require many fewer kilowatt hours per year. Without considering the air-conditioning saving, however, there is a direct saving of about 7,800,000 kwhr's per year against the present expenditure of 8,760,000. This is enough to keep a village of 6,500 people supplied with a budget of 5,000 kwhr's per year for each family.

Since this was reported, there have been some changes. According to *Electrical World* (January 1, 1973), the lights are no longer kept on 24 hours a day, and there is some selective switching.

Existing lighting installations can be modified more easily than exterior walls, complex heating and cooling systems and ventilation systems.

A 50 percent reduction in electric usage for lighting would be a three percent reduction in nation-wide energy use. This is equivalent to the output of over 30 1,000-megawatt generating plants.

The question has been discussed in some detail for the past couple of years. The spokesmen for the Illuminating Engineering Society and their sponsored research arm, the Illuminating Engineering Research Institute, have insisted their findings have been misinterpreted and misapplied. Nevertheless, there is no literature coming out that shows how to design and provide controls for lighting that will significantly reduce electrical consumption. It is time to call on the industry to produce some illuminating components that perform quite differently from those that fill our new schools and buildings.

It is encouraging to learn that the American Institute of Architects has disaffiliated itself from the joint committee on school lighting with the IES, and will work toward a new approach to school lighting design with the Educational Facilities Laboratory.

The IES has such a long standing commitment to the light evaluation system based on the 1958 Blackwell Report that a fresh overall investigation of how to provide a satisfactory seeing environment for carrying on our daily activities at the lowest energy cost is almost impossible to expect.

The characteristics of the new lighting: A more efficient light source; a lighting component capable of being easily plugged in and removed as requirements change; one capable of delivering a number of levels of light; one easily controlled locally; one fitted with a light-sensitive device that will turn it off if the ambient light level is adequate; and one that will accept screening devices when necessary.

The lighting design standards will eliminate the shibboleth of more than three to one contrast. This is not only contrary to the activity of the eye in nature, but also counters the experience of people watching a drama or film where the task (the stage or screen) is brilliantly lighted and the surrounding area is without light. The contrast between the light from the sky and the light in shadow areas under trees can be 20 to 1 (or more) without causing discomfort or loss of discrimination. In contrast, an unrelieved snowfield can be fatiguing, disorienting and can produce such physical symptoms as headaches and nausea.

The idea of lighting designed for specificity of delivery is certainly not new. Moreover it works effectively wherever it is installed. Examples are an operating room light, the light on a drafting table, the small lamp attached to a sewing machine, the built-in lamp in a study carrell, the individual lights over airplane seats, the light over a pool table, the illuminated instruments in an automobile. In commercial buildings there is no area that cannot accommodate an electric typewriter, a desk computer or an electric coffee maker; which means the area can also accommodate local lighting, either attached to the equipment or free-standing to serve it.

The remote-control device for changing television channels suggests a type of control by which a person could selectively turn lighting on and off, or change its intensity.

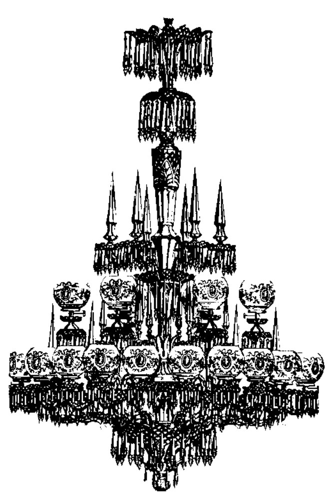
In a universal ceiling grid, fixtures could be plugged in or removed to change the light delivery system for different programmatic requirements. The animated movable electric signs in Times Square hint at the variety of levels and points of illumination we could have in a space.

Since there is so much to be gained nationally by reducing unnecessary electric use, the reduction of unnecessary lighting, as well as other technological possibilities, should be immediately investigated (low voltage switching systems, for one).

The great benefit of the modified approach to lighting design—differentiated spaces, contrast and lowered ambient levels—is the improved architectural quality. The building begins to respect and respond to changing human needs, and to variations of climate and weather.

Two recent findings may have some bearing on performance requirements. First, the report on job dissatisfaction among assembly line and production workers. This stated that despite "efficient" work conditions, psychological factors caused reductions in productivity which could be offset by less routine work assignments and less undifferentiated environments. In place of assembly lines, experiments with assembly teams, putting together SAABs and Volvos in Sweden, resulted in dramatic reductions in absenteeism and defective workmanship. Second, it was reported by a CBC radio interviewer that a Canadian school found that reducing light levels in a new school noticeably reduced psychosomatic headaches and fatigue.

In looking critically at energy use, the amount of energy used for advertising purposes is generally lost in the commercial category reporting. Aside from giving information—the name of a hotel, the number of a building, similar messages, most merchandising lighting is either excessive or superfluous. During the war years of 1942 to 1945, the extreme situation of no advertising lighting pertained.



Versailles chandelier.

Airplane reading light.

Globes—New York University housing (I.M. Pei).

While it was by no means a relaxed and joyful setting (one of the environmental tunes of the day was "When the Lights Go On Again All Over the World," as an equation of lights and peace) it did demonstrate that we could indeed survive without advertising lighting.

The ironic part about advertising is that a high light level, if it is used to overwhelm the message of its neighbors, is only effective if it is the highest light level around. As soon as a new high is established, the tendency is for others to seek a still higher level. This is kilowatt one-upmanship.

The light level intensities can mount from 100 to 200 to 300 to 400 (and higher) footcandles, and do so very rapidly. Each advance cancels out the merchandising advantage of the one before it. The only way to avoid such an escalation is by having a limit on intensity that is either voluntary, or enforced. When this is done, ingenuity will replace sheer brute brightness.

The wonderful effect of tiny lights strung in trees was demonstrated in New York last Christmas as an increasingly popular technique for decorative lighting. Blocks along Park Avenue and the Avenue of the Americas were given a magical scintillating quality. All told, about one half watt was used per square foot. By contrast, the business streets in Las Vegas have so much wattage that the various messages are virtually cancelled out in the glare.

Lighting in residences has remained closer to light levels people enjoy, especially since there is no one goading them to increase levels for sake of performance. As a result, home lighting was considered undersaturated; that is, it had the potential for being appreciably increased and, energy shortage or not, there are promoters in the electrical industry who want to push up the amount of electricity for home lighting.

In an account of Edison Electric Institute's 1971 Annual Marketing Conference, *Air-Conditioning, Heating and Refrigeration News*, a trade weekly, ran a report about Edwin Vennard, former managing director of the Institute, commenting on residential lighting: "Lighting always stands out as one of our best builders of percent return." Mr. Vennard mentioned that the electric industry had failed to sell higher lighting levels at the residential level where, he continued, "We give them about 20 foot-candles." By raising the average wattage of all electric bulbs used in houses just 30 watts, there would be more net income for utilities "than in all existing house heating. I'm not saying neglect house heating, but why not have both?"

It is ironic that if we attempt to describe the most pleasantly lighted spaces we can think of, our thoughts turn to certain residences. Softly lighted restaurants, theater lobbies and other spaces whose performance requirements have escaped the foot candle escalation process. Judging from the above quotation the watt salesmen are zeroing in on these.

Electric Heating

In considering Mr. Vennard's last sentence we come to another emotionally charged subject, electric heating It would be wonderful to find that it really uses less energy than all those other crude, primitive and expensive systems. It is obvious that costs of installation are generally less than for hydronic fossil fueled systems. No boiler rooms are necessary, no chimneys; instead of conveying heat as a liquid or a gas in pipes, it is transmitted through copper wires that can turn corners more readily and don't require pitches for drainage. Controls operate an on-and-off switch instead of a valve or pump.

Unfortunately the basic production of electricity is so inefficient in converting heat to electricity (which can be converted back to heat) that the advantages of electric heating are offset by the cost of operating it.

In the years 1963-70, it is possible to see the result of the promotion of electric heating on the residential use of electricity. For a decade residential use represented about 30 percent of the total sale of electricity. On a per capita basis, the average increased at the same rate as the general increase in electric usage. That is, it doubled while the population increased by 15 percent. In 1957 there were 167,758,000 people, using 161 trillion kwhr for residential use. In 1967 197,374,000 people using 332 trillion kwhr. Each average family used 3,660 kwhr per year in 1957 compared with 6,420 kwhr in 1967. Suddenly, in 1968 there was a sharp increase in the amount of electricity used in residences, beyond the general rate of increase for electricity. Residential use of electricity within two years jumped to 32 percent of all electricity sold.

If this merely represented a shift from one source of energy to another with no other consequences, it would be interesting as a technological shift. It has more serious results however and complicates the problem it purports to solve.

It may be worth repeating that electric heating is basically wasteful of primary energy, largely due to the three to one inefficiency in converting primary fuel to electricity. The 11,000 (plus or minus) Btu's required to generate a kwhr have a heating value of 3,413 Btu's at 100 percent efficiency in the reconversion process. If primary fuel (oil or natural gas) is burned directly, even if it is burned at only 60 percent efficiency, it will use only half as much fuel as the needed heat supplied by electricity.

The different fuels are interchangeable and interdependent. In the New York City area, for example, gas turbine peaking units are providing some of the base load. These units, basically jet engines, operate on kerosene or No. 2 oil. As they convert it into electricity, used for heating, they contribute to the shortage of fuel oil for heating.

According to New York City officials, one quarter of Con Edison's generation is now in gas turbine units, over 2,000 megawatts worth. Originally planned as peaking units, they now are part of the base load supply. They use No. 2 fuel oil, the oil used in home heating furnaces and boilers. The shortage is being worsened since electricity for home heating drains off twice the No. 2 oil from the market that would be required for direct combustion at the houses.

Similarly, where natural gas is available, it is used to generate electricity which, in turn is being used for heating that could be done more economically from a fuel use point of view by using the gas directly.

A rationale of the utilities for using electric heat is that it is required at a time when operations are below their peaks which occur, excepting a few northerly areas, during the summer air conditioning period. There are two flaws in this. First, we are faced with shortages in all primary fuels—oil, gas, fissionable material and available low-sulphur coal. Predictions for the exhaustion of these resources suggest that they had better be used carefully until alternative power sources have been developed and made available in sufficient volume to replace the present generating and petroleum refining capacities. The absolute reduction in primary fuel use becomes more important than the more profitable use of generating facilities on a year round basis. The result of burning less fuel (and still providing the same basic performance standards) is also the reduction in pollution. The second point, however, is that the promotion of electric heat does not affect only the winter loading. The all-electric home is given more favorable rates year round than the non all-electric home. For over 360 kwhrs per month, the service classification for electric heating lists only 60 percent of the non-heating customer's cost during the eight heating months and only 75 percent of the non-heating customer's cost in the remaining four months. As a result the favorable rate structure makes electricity attractive for cooking, clothes drying, and hot water heating in addition to the space heating. It also encourages the use of more air conditioning. These additional electric uses tend to drive the summer peak still higher, resulting in still more winter time capacity to be exploited for electric heating.

If the controls and delivery of fossil fuel systems were as effective as those in electric systems, there would be no basis for discussion. The difference would be three and a half to one in favor of the fossil fuel. As the result of the losses in combustion and delivery, and of less specifically responsive controls, the edge drops down to about two to one. Even with boiler inefficiencies and chimney stack losses, direct use of fossil fuel is generally twice as efficient as electric heat, and does not cut into generating capacity.

The only promising use of electricity for heating under present methods is the heat pump. In the past this has been so beset with poor performance equipment that it has not been actively pursued.

The impact of additional electric heating on overburdened generating capacity can be appreciated by looking at actual quantities. In New York State, depending on location, between 10 percent and 50 percent of new homes have electric heat. In other areas of the country, that figure is higher. According to figures from Pennsylvania Power and Light, the average all-electric house in 1971 used 28,000 kwhrs, while the non-electric one used 5,600. That leaves an average of 22,500 kwhrs for heating. Applying this figure to the one percent of New York State's 5,300,000 residential customers, who now use electric heat, it turns out that 1,200,000 megawatt hours went into electric heat last year in this state—the total output of a 240 MW plant such as Indian Point 1. The amount of fuel which went into generating power to heat these residences could have heated about two and a half times the number of residences directly, given the same standards of construction.

In 1970, with a seven and a half percent saturation of the residential market, electric home heating used about 66,000 million kwhrs of electricity. This represents almost four percent of all electrical energy produced and sold. In other words, if the ratio of capacity to consumption of the Con Edison generators is used, a total of about 16 million kwhrs capacity is required—the equivalent of twice the total capacity of all of Con Edison's generators.

According to "Electric World", the preference for electric heating has increased from 22 percent to 36 percent during the last six years. The electrical industry projects that the number of electrically heated residential units will be 19 million by 1980 and 25 million by 1985.

The annual electric consumption, if this prediction came true (assuming established 22,500 kwhrs per unit per year), would be 562.5 billion kwhrs. In primary energy, this would require about 6.5 billion (10^{15}) Btu's, and would be the equivalent of a 50 percent importation of petroleum in 1985. This is obviously a matter to be decided on something other than first construction cost.

In addition, there has been a successful campaign on the part of the utility companies to increase substantially the amount of electrical heating in office buildings and other commercial installations. In 1969, of all new non-residential construction, 23 percent was electrically heated, a total of almost 40,000 buildings of which 5,400 were new office buildings.

A governmental policy, expressed in codes and power use regulations, is necessary to stop this tendency, one that permits electric heat only in installations where fuel deliveries cannot be made or where the presence of an open flame in an unattended building would be either unsafe or undependable.

The Mechanical Plan

In analyzing building demands on energy systems the most common practice has been to analyze each energy consuming activity and find ways to lessen the demands of the building and improve the performance of the equipment. The equipment analysis has been especially fruitful since it can be isolated and examined. While this approach tends to perpetuate some of the attitudes that produce the crisis of direction our buildings now face, the improved knowledge of system performance is most useful.

The crisis referred to is the fragmentation of building decisions—the consideration of mechanical systems as something separate from the basic building design. In reestablishing a unified approach to building design, it is obviously essential to incorporate all that has been learned about improving the plant. Without attempting to re-record all the things that have been listed in some excellent recent articles, it may be worth looking at a few that deal with principles.

The underlying idea of total energy is so fundamental, so sound, that it is incredible to think of it as a new concept. The idea of the interrelationship between various energy uses only needs the next expansion. The inclusion of the natural (non-mechanical) energy exchanges begin to be a true total energy system. Certain misunderstandings about terminology bear correction.

The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRA) describes Total Energy as follows: "Total energy is a term designating on-site electrical generating systems arranged for the maximum utilization of input fuel energy by salvaging by-product or waste heat from the generating process."

When described as a steam turbine electrical generating system, one using some of the lower temperature steam for such processes as heating or steam cooling, the overall thermal efficiency of the system is improved, although the direct production of electricity from the steam may be somewhat diminished. In order for such a system to maintain the theoretical efficiency it can achieve, there must be an economical use for all the low temperature steam at the time the electric generation is required. There are systems that also incorporate waste heat from refrigerators, lighting fixtures, vented heat from cooking equipment, the heat from burning wastes, and other heat that would otherwise be considered waste.

One principle that affects mechanical equipment has to do with the efficient performance of the equipment itself. While it seems embarrassingly obvious to say it, there are hundreds of thousands of boiler installations in large structures that have been designed with such safety factors that they never operate at maximum capacity. Modular boilers, which accommodate only a part of the total maximum load, can operate closer to design capacity more of the time, with savings of 20 percent and more in fuel consumption. The idea of using modular boilers merits wider investigation.

There is a large overuse of energy resulting from an underuse of selective controls. One of the disadvantages of central systems is the inability to respond to local variations. Many air conditioning systems that are quite efficient in operating central equipment lose that efficiency because the system blows a pre-determined amount of cooled air into all spaces, regardless of whether they are in use, whether there is heat-producing equipment and whether the sun is striking that part of the building.

With their inefficiency as generators, individual through-the-wall-units are sometimes more efficient on an overall basis because they can be turned on and off selectively. A trade-off situation exists that merits study of improved local controls for central systems.

The problem of inadequate cooling controls can be exacerbated by providing controls that do not reduce the amount of cooling when it is not required but instead add heat to warm up the too-cool spaces. These systems, called terminal reheat systems, make the comfort controls a little easier, but are wildly extravagant in energy use. The introduction of only the necessary amount of cooling (a logical enough idea) has only recently received the attention of mechanical engineers. It has been described as a variable volume system and, not surprisingly, has been found to be considerably less energy-expensive to operate.

In the past, and in the present as well, refinements have been ignored since they tend to increase first costs. Construction costs in themselves are so important to clients, whether public or private, that long range savings are given up in order to keep visible first costs as low as possible. The concept of *life cycle costing* can demonstrate the basis for both eventual dollar savings, and lessened energy use—a concept we'll discuss a little farther on.

The efficiency of units is under considerable investigation at the moment and, contrary to general experience in most fields, not only is there no advantage in oversized individual units, there is actually a collective disadvantage. Over-sized air-conditioning units tend to satisfy the cooling requirements more rapidly than those designed very close to proper capacity for their job. As a result they tend to cycle much more frequently. When you have a situation, as you do in New York, where almost a quarter of a million new units are purchased annually, the additional draw that this more frequent cycling requires becomes a significant additional user of electricity. Further, the difference in the delivery of cooling per kilowatt of energy going into the units themselves varies by almost two to one from unit to unit. Since this information is not generally known to purchasers of equipment, and since first costs often take precedence over the actual operation and maintenance costs, there is a tendency to purchase less efficient air-conditioning units that consume, over the long run, considerably more electricity than they need. New York City has led in making this information available to purchasers.

The Mythology of Ventilation

Progressively more complex systems are still being installed in buildings because, at one point, there was a popular concern for some health or safety requirement which assumed a life of its own after its incorporation in regulations. Ventilation standards come into this category.

Ventilation, a large energy consumer in sealed buildings—on the order of ten percent of all energy used in the building—is generally determined by completely unsubstantiated standards such as air changes per hour or air changes per occupant, with great variants from code to code and according to described space use. Probably only NASA or the submarine service have gone into true physiological studies of air needs. Yet these are not applied to building problems. Moreover, no consideration is given to the quality of the outside air that is introduced into the interior—conditions that vary from satisfactory to unsatisfactory in atmospheric classification.

An old building with theoretically operable windows needs no supplementary air system unless it has interior toilet rooms. Even with windows painted shut, the air moving through the buildings comes in by infiltration through cracks, doors to the outside, or air intakes for combustion, and is distributed through the building by the stack action in stairwells and elevator shafts. The building itself has a certain respiration rate. The great problem in designing sealed buildings is to frustrate that natural respiration rate by better caulking, tighter seals and so forth and then instead of having the air permeating the face of the building it is introduced at one place near the mechanical room, pushed through the building with fans, distributed through a whole network of ducts and brought to the same place that it wanted to be in the first place. All this requires extensive mechanical intervention. A more controlled and reasoned version of this might sharply reduce the electric energy use that is represented by ventilation equipment.

Cluster development plan, Alberobello, Italy.

Aside from the direct energy required to operate fans, motorized dampers and other ventilating equipment, there is a major energy loss in dumping heated or cooled air outside of a building and then heating or cooling the replacement air. Ironically no one evaluates the quality of the outside air that will be brought in. Furthermore when there is the possibility of introducing outside air through windows or louvers on exterior walls, the internal ventilating systems can be eliminated or reduced. The choice then rests with the occupants of the space either to introduce outside air or not. Since this item represents ten percent of the electrical usage in a high-rise commercial building, or five percent of the total energy consumption, a 50 percent saving would contribute significantly to its reduced energy consumption.

First-cost Mentality

The overuse of energy is made inevitable and is exaggerated by first-cost economics, overstated performance standards and fear of liability. These have combined to distort the planning process.

In referring to buildings, magazines, clients and architects always cite construction costs—so many dollars, so much per square foot, so many dollars per pupil or classroom. There is never a reference to the cost of energy per square foot or Btu's per square foot or kwhr's per pupil. In reality, many buildings spend a dollar and more per square foot per year for energy costs. As a rule of thumb a reduction in actual carrying costs can offset ten times that amount in original costs. For example, if the building mentioned above were to reduce operating costs for energy by twenty-five cents per square foot, it would permit an additional $2.50 per square foot in construction costs. And, in the continuing escalation we face, operating costs increase from year to year while paying for construction remains constant from the year of financing.

Part of the problem stems from the method of financing, selling and renting. Municipal and governmental agencies separate capital budgets from operating budgets. Capital expenditures are generally paid for by bonds, while operating revenues come from annual tax funds. As a result, the interconnection between the two is usually lost or ignored.

An approach that begins to bridge the gap has been developed. Bids for heating systems are in two parts, one for installation, the other a guaranteed bid for the maintenance and fuel costs for a five-year period. The job is let on the basis of both.

Life cycle costing, the projection technique that considers costs through the life of the building can often demonstrate the speed with which a well-designed, well-insulated building can ultimately save money through higher performance.

A study by John Moyers at Oak Ridge National Laboratory made some comparisons between residences with minimum insulation and those with full wall and ceiling insulation, and with storm sash. An annual cost was developed for the interest and amortization on the cost of the insulation and double glazing. This was offset against the annual energy saving. With electric heating, the upgraded building paid for itself in less than four years. With gas heating the differential was not as great. In the two years since the study, however, the cost increases for natural gas and the projected fuel increases reflecting higher well head prices and the considerably greater cost of liquefied natural gas brought in by tankers and stored, sharply change the economics to make added insulation even more desirable. The original study was made before the FHA upgraded the insulation requirements in its new minimum property standards.

The life cycle cost problem is not easy to overcome. Many school building referendums have been defeated when the buildings appeared to be more than minimal. Even where the economics can be demonstrated to be favorable, there is an immediate tendency to think only of the lowered first cost. A merchant builder in Minneapolis, talking to an energy conference, stated categorically that he would be unable to build and rent office space competitively if he added first costs that exceeded those of other builders and that he would lose the opportunity to build on prearranged contracts if his unit costs were higher than those of his competitors.

Our tax structure also favors the separate consideration of building and maintenance. Corporate capital improvements are conspicuously isolated. Operation, including energy usage, is buried among a large number of unrelated expense items. The interrelationship is often lost.

The sale of speculative houses, and rentals with tenant supplied services both encourage lowest first cost, regardless of the ultimate extravagance in maintenance. For example, a recent ad in *The New York Times* offered apartments in a condominium in New Jersey. The text: "This 2-bedroom, 2-bath apartment home costs $373.44*/month. . . ." (The asterisk is in the ad.) The footnote: "*Based on 7½ percent 30-year mortgage following 20 percent down payment . . . includes estimated real estate taxes, estimated common expense. *Estimated cost of electric heating and cooling not included. . . .*" (My emphasis.)

The statistics of energy saving are easier to establish mathematically than to verify in actual practice. After careful determination by computer simulations that different methods of supplying services vary by a precise percentage, we learn of gross variations that must be attributed to the personal factor. A study is being undertaken in Princeton, New Jersey by Professors Socolow and Grot to measure actual consumption of energy in a new community of 1500 dwelling units in Twin Rivers, New Jersey. Their preliminary findings show a variation of two times the energy use in identical units. A similar study of two identical schools in Michigan showed the same variation. The implication of this is that human nature and habit may be another really critical factor in energy consumption. The variations in statistics, however, are averaged in use. Cumulatively, if they were implemented, they would extend the time available to develop alternative energy sources and remove the immediate necessity for expanding energy production, allowing decisions without the hysteria of near-crisis breakdowns. Rediscovering the real world of seasonal changes and sunshine would be an added bonus.

THE ARCHITECT'S POSITION

Buildings reflect architectural decisions as incorporated in working drawings, bid documents and field instructions. These decisions determine configuration, materials and the basic energy use patterns required to operate buildings through their lives, as well as the additional materials required to maintain or modify them for new uses.

These decisions are not made unilaterally by the architect. They are modified—sometimes even predetermined—by a variety of participants: The client, the lending or financing agency, public opinion, current stylishness, available materials, and economic priorities. Regardless of where the credit or blame lies, the end product, the buildings, are responsible for about a third of all energy use in the United States, a good part of which is used unnecessarily. There is no part of building or operational procedure which is as efficient as it could be in its use of energy.

Even assuming that all the projections, assumptions and statistical bases are excessively pessimistic, the underlying message requires some decisive shifts in our customary design philosophy. The decisions made by architects and engineers can reduce energy expenditures in our buildings by at least 50 percent with no penalty to the quality of life in our buildings—possibly even enhancing them. By taking a fresh look at our stock of existing buildings we can reduce their energy expenditures up to 25 percent on the average.

All this brings us back to the point that fundamental changes in attitude will be required of all of us.

As an architect, I find the whole concept completely consistent with what I had been educated to believe and have since held firmly. The nature of the generative process of architecture is that every component, everything we deal with, everything we use in architecture must be used precisely, intelligently, effectively and economically to do the tasks that are required of it. For the last couple of decades I have been disturbed at what I consider to be an unfortunate tangent that has developed. Buildings of really poor performance have been built, buildings have been built unnecessarily, various configuration complications and protuberances on buildings have been justified as creating visual interest. One result has been the demeaning of the role of architecture.

The reinvestigation of energy use in buildings is part of investigating how buildings use *all* materials.

The architectural mission can no longer be looked at as one that thoughtlessly fills every maximum desire, nor can it be considered as purely responsive to the economic pressures that lead to building for profit. It must be looked at as an activity that consumes energy and material, a consumption that further reduces the irreplaceable reservoir of resources.

This suggests the problems we face and the decisions required. My own feeling is that there are going to be increasing restraints on energy commitments and sharp changes in the ways buildings are planned. Obviously, the simplest way to avoid unnecessary energy use in buildings is not to build. In many cases that is probably a good answer. If there are buildings that are not necessary and if, on the other hand, there are unfilled needs, it may require establishing building priorities, what materials are available for buildings in comparison with other products, which things are done and which things are not.

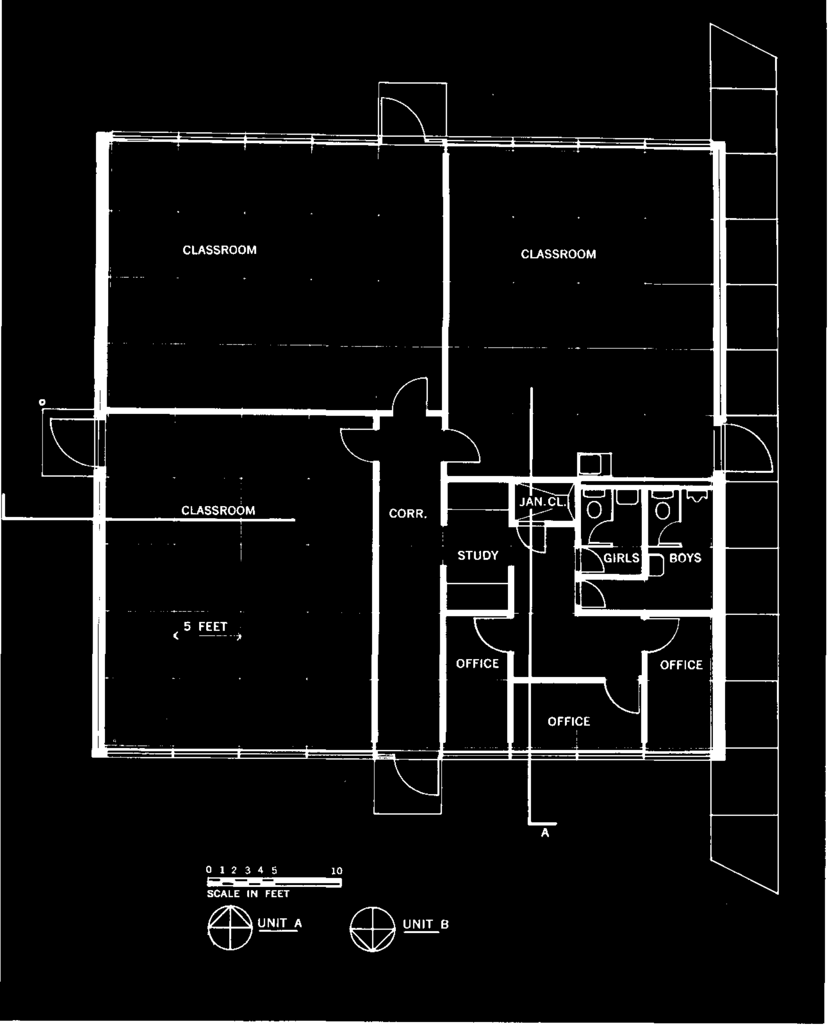
The architect's adjustment of attention to solving building problems, with intense concern for the use of materials and the impact of environment, is in the long tradition of the profession. Architecture has evolved from the response to programmatic and environmental constraints expressed within available technological means.

An area that is often discussed between architects and environmentalists concerns what and how to build, how or whether to reshape the natural environment for man's uses. Essentially this is the whole course of civilization, from the time the first trees were felled, the first cave cleared and the first stream diverted. The landings and orchards along New York's Hudson River, the piers and clusters of houses along its banks, and the fine old mansions with their panoramic views, all bear testimony to the skillful reshaping of the terrain for human use in the past.

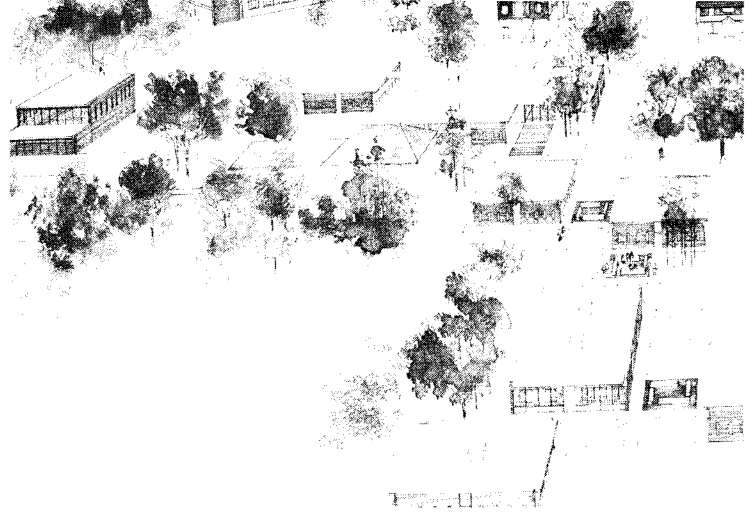
Where building forms were once produced with abundant, cheap labor, somewhat costly materials and very costly machinery, the situation has shifted to the point where everything is costly, but especially field labor, resulting in changes in prevailing design criteria.

Now, rapidly rising energy costs alone point to a reversal of the trend. Based simply on the anticipated cost of maintaining the building, it is in the best interest of the client as well as in the best interest of the public for us to redefine our criteria, becoming more specific and more exacting in the performance we require from our buildings themselves.

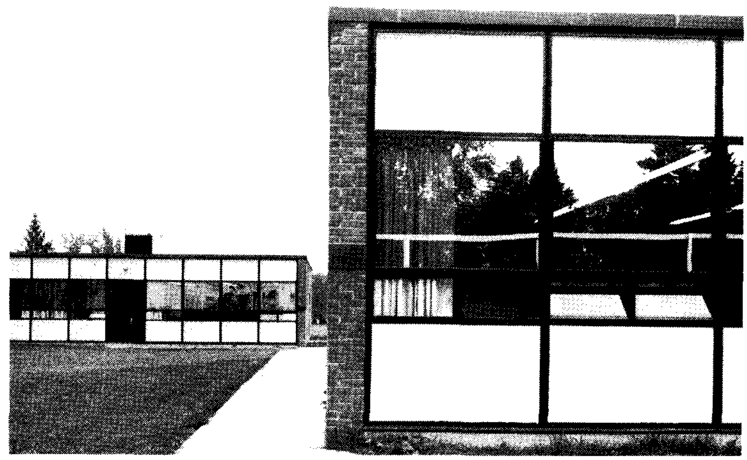
One area worth considerable additional study is the reinvestigation of building components in order to redefine their functions. For example, if the building wall is considered as an energy transmitting mechanism, then it will be designed very differently from the way it is now. A recent publication showed the study that went into the design of the curtain wall for the World Trade Center in New York. Aside from the fact that nine million pounds of aluminum (a high energy metal) went into this wall, the major functional job given to the wall was to blunt and turn back the winds, the penetrating vapors and the other atmospheric intrusions of the world outside, so that a completely controlled interior environment could be achieved by air conditioning and heating. Actually, if the performance were redefined to per-



Oakwood School floor plan.



Master plan, Oakwood School, Poughkeepsie, N. Y.



New buildings viewed from the south.

mit outside air and ventilation to be introduced in the quantities required, and to allow the air temperatures outside to be taken advantage of when they were within the temperature range that was being provided by the mechanical systems, a very different sort of skin would have resulted. It is quite probable under those circumstances, without any change in the size of the building, that a significant percentage of electrical generation could have been eliminated instead of ended up with enough to supply Schenectady.

This sort of design direction suggests a parallel attitude in designing mechanical systems. The relationship and work arrangements between architect and engineer are one key to the success of this effort. Their various decisions are interdependent and must be generally clarified before the building design is committed.

The schematic phase becomes critical in regard to eventual energy consumption. It no longer suffices to think of it merely as the general arrangement of spaces to satisfy an owner's requirements. The engineer must be involved more fundamentally at this earliest stage so he is not presented with a pre-fixed condition which reduces his job to somehow making it work mechanically. While such a relationship has always been desirable, it has not often been adhered to.

More exact mechanical systems would necessitate such additions as a responsive control system—something generally desirable but often eliminated because of visible initial cost.

The matter of *visible* initial cost merits more comment because, interestingly enough, if savings (often *invisible*) are taken into account, many higher performance requirements can be provided with no penalty to first costs. In fact, there may be savings.

For example, we recently designed some small classroom buildings for the Oakwood School, a Quaker school north of New York City. We had designed a master plan permitting them to add incremental units of about 2,500 sq. ft. each, self-contained buildings that could be built as money became available and would fit into the overall mosaic.

The plan concept was extremely simple. The structure was supported on masonry bearing walls. The non-bearing walls admitted light and air, through a curtain wall assembly. The program required air conditioning for year round use. The least expensive curtain wall placed a heavier dependence on the air conditioning and heating system and required a base heating element at the curtain wall. A higher performance curtain wall, also permitting natural ventilation, was designed with double-glazing in neoprene gaskets, well-insulated infill panels, and selective ventilation in heavy weather-stripped steel sash; heat reducing glass was used on the south. The openings were oriented north and south to avoid uncomfortable east and west heat gain.

These decisions eliminated the supplementary heating at the exterior walls and reduced the size of the heating and cooling plant for each unit. This constituted an overall savings in first cost, in operating cost, as well as a higher performance.

However, the increased cost in the exterior wall construction was visible. The savings in mechanical plant and operating costs were not. In many instances the decision is made on the basis of removing visible expenditures even though it results in greater expense elsewhere in the construction budget.

Along with redefining the function of building parts goes a reevaluation of physical requirements. Optimum and variable lighting levels, as previously discussed, are one area of concern. Optimum and variable heating levels are another.

In schools, for example, most heating levels are set to satisfy the teacher's requirements rather than the children's. Unfortunately there are metabolic changes that cause us to expect somewhat higher temperatures as we grow older. I know the suggestion may be controversial, but might it not be sensible for teachers to dress more warmly?

Where the class pattern is one of activity and movement, a lower temperature of several de-

grees may be required, compared to a class activity that is basically sedentary. Moreover, the heat contribution of active children and the time lapse and temperature overrides of most systems indicate that our provision of temperature conditions in class rooms is startlingly crude and wasteful.

In all types of buildings, we generally seem to have a capacity as a nation for overheating in winter and overcooling in summer to the point that it is now more comfortable to wear summer clothes in winter and heavy clothes in summer.

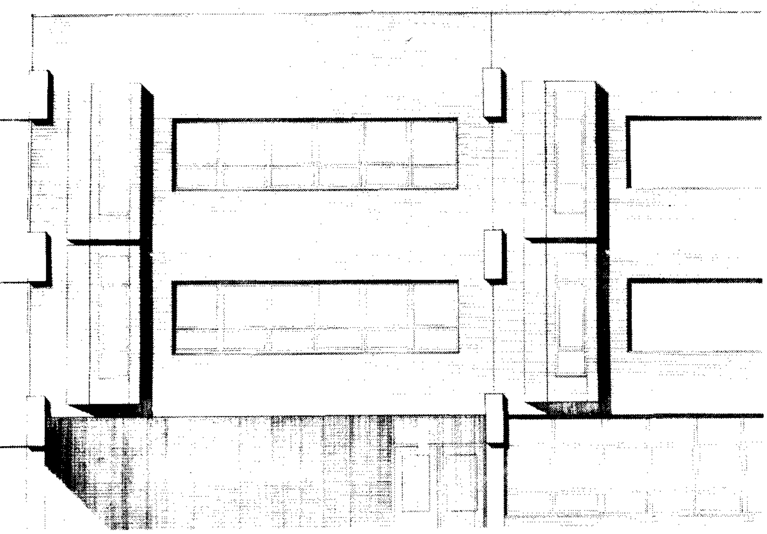
In redetermining our physical requirements, we will again realize that we live in an environment in which natural elements can be exploited.

Such a strong reliance on mechanical systems has developed that performance possibilities of the building itself have been downgraded. Air conditioning has been made mandatory 12 months a year even in climates where outside temperatures are delightful most of the time. While we profess interest in visual continuity between indoors and out, we eliminate glass in some areas, overuse it in others, set up intolerable heat gain and glare conditions, and often cut out light switches in naturally lit sections. In other words, one often can't take advantage of natural elements even when they are so readily *there.*

An elementary school we designed for New York City in Staten Island has a fenestration system designed to provide a usable strip of natural light adjacent to the exterior wall. The lighting fixtures above this strip are separately switched. In order to have light without glare, a light scoop is provided at the front of each classroom throwing light on the chalkboard well into the room. The light scoop is baffled to eliminate the point of sky glare that sometimes negates the effect of natural light. The sash permits controlled ventilation through hoppers and projected sash.

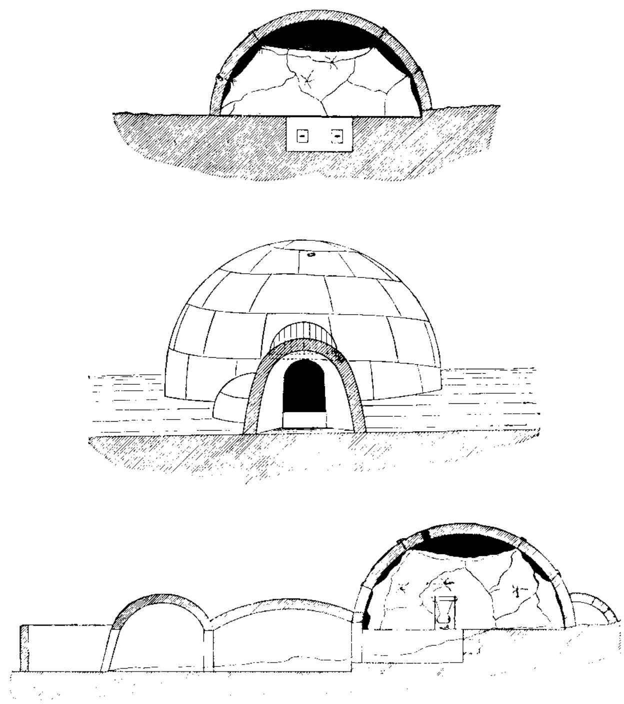
There are two basically different approaches being followed to achieve energy savings in buildings. One is stabilizing the inside environment by a tight skin with minimal thermal transfer and with the minimum surface area to contain the required volume. By refining mechanical performance and taking advantage of the interdependency of various systems, it is assumed that the greatest efficiency will be achieved.

The second approach assumes that the outside environment is not hostile, certainly not at all times. It contains many features that can be understood and exploited—admitted when they contribute to the inside comfort and performance quality, excluded when they are undesirable. Among these are solar heat, cooling outside air, natural light, wind energy, water. By positioning and dimension-



P.S. 55 Staten Island.

P.S. 55 south facade.



The Eskimo Snow house, built in the unfriendly climate of Hudson Bay, provides comfort with a minimal input of energy. Very little outside air is introduced—only enough to support a small fire. It comes in through the triple set of portals, each about three feet high and protected with double hangings of skins. The main room under the larger dome has a complete hung lining of sewn skins to retain heat and keep snow from melting. The heated air to be replaced by fresh air for the fire is exhausted by gravity through a small hole cut into the wall near the top. Aside from body heat, there is heat from a small fire of burning blubber in a soapstone container. A wick of reindeer moss burns with a low, horizontal flame. In addition to providing heat, the flame provides light, serves for cooking and dries wet mittens and clothing. It is just hot enough to melt a little more blubber to keep the wick saturated. Clear ice is set into the dome over the entrance to let in light. In its simplest form, it is built of available material (snow) in about two hours, by two men.

ing buildings to take full advantage of these impacting forces, a major part of the energy requirements can be taken care of without mechanical intervention. The mechanical systems will be installed to provide the difference that cannot be provided non-mechanically.

The question is not academic. It determines the shape of our cities and variations from region to region. It will affect what components are developed and what wall assemblies we can work with.

In addition to reducing energy consumption through developing more precise building requirements and function, we can reduce the demand for energy for space conditioning further by taking advantage of the environment. The basic principles involved can be seen in practice everywhere man has had to live without the benefit of cheap and readily available power. In these places human ingenuity has been brought to bear on ways of using the materials at hand in order to take advantage of the benefits of sun, shade and wind, while being shielded from their negative aspects.

We are better advised to observe those countries which have technologies and life styles akin to ours but which have not been able to consume energy with our prodigality.

In all the Mediterranean countries building walls are surfaced in white or light colors to reflect heat. Grillwork and shutters allow air to flow freely while providing shade and privacy. The mass of the heavy masonry construction achieves a delicate balance with the daily heat flow. It continues to pick up heat during the day, but the heat just begins to penetrate into the space at nightfall. It continues to lose heat to the inside space during the cool night and is then ready to begin its diurnal cycle again.

In the northern European countries the same principles apply. In Switzerland, for example, there is wide use of rolladen, an exterior shading device which combines the function of the awning, the window shade and the venetian blind.

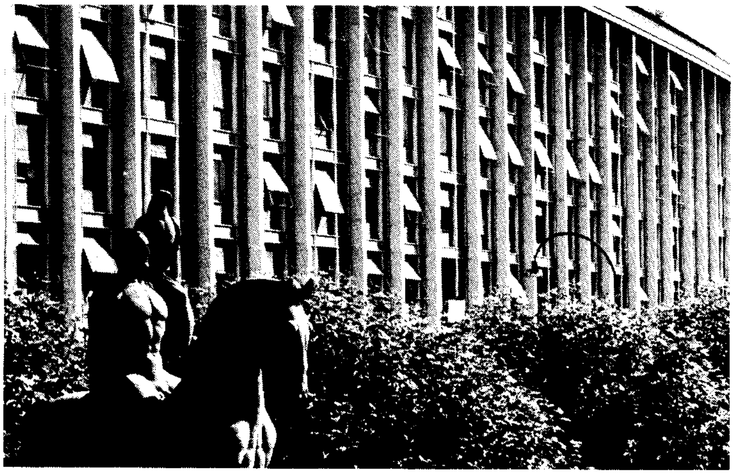
The possible variations in admission of light and air with these shades lower the air conditioning demand or obviate it.

The same sort of approach is seen in this country where energy costs are high or where we have been conditioned to believe that the particular environment is beneficial and one which we ought to experience directly. Somewhere we have lost track of the notion that it would be best to do things simply.

House on Martha's Vineyard

When we designed this house in 1965, energy conservation was not a goal per se. However, adhering to an architecture attuned to its environment and to the essentials of program, the building takes advantage of the natural phenomena of sun and wind for part of its heating and all of its ventilation. (Intended basically for summer, it has been used in early spring and into late fall.)

- The system of sliding doors and shutters permits maximum flexibility in admitting or excluding both sun and breezes.
- The open porch in the center makes it possible to open either end of the house to the outside on all four sides.



The rolladen, for individual window control, as shown here at the Hotel du Rhone, Geneva, are stock items in Switzerland.

Observation

Around New York City, in the 3,000 out of some 8,000 hours a building is occupied during the year, about 500 hours of outside temperatures are suitable for introduction into a building. At these times it ought to be done so you don't disregard the lovely weather outside while manufacturing similar lovely weather inside.

Of course, the less a country or culture is able to depend on mechanical solutions, the more specific its architecture is in dealing with its particular environmental problems. While the specific problems will be somewhat different from ours, the approach remains the same; basically, that of stabilizing interior temperatures and controlling air flow.

In Ethiopia, for example, a typical method of construction is packed mud walls on a latticelike framework of eucalyptus branches. The roof is thatch. Although there are doors and windows built into the walls, additional ventilation is provided by leaving off the mud in some places. Here, where a hot dry season alternates with a torrential rainy one, and where the wind direction is predictable, it is possible to find houses with only one solid wall. All that is needed is a rain shield.

We can learn from this. There is nothing that says that the south wall and the north wall have to be identical any more than there is anything that says that a building in Montreal has to look like a building in Houston. By readdressing some of these problems a number of things will occur: The question of regional differentiation will begin to manifest itself out of necessity. In addition to regional differentiation, the building itself will no longer repeat a single wall section—head, jamb, sill, floor and corner, but will begin to change sharply. A diversity of form and solutions will develop, but a diversity tied together through its unity of purpose. This won't be the diversity we now equate with bizarreness, but the diversity which differentiates one tree from another.

- All openings are screened and can be closed by plywood hinged panels (in the projecting windows) and by wood barn doors elsewhere. The roof is insulated and reflective to avoid an overhead radiant panel. The living room wing (slab on grade) is designed for fall use since it does not have through-the-floor heat loss.
- Supplementary heating for cold evenings or sunless fall days is provided by a small wood-burning stove, cast in concrete to retain and radiate heat.

The Integrity of Natural Systems

Through determining mass, materials and openings, certain vernacular building types have achieved a delicate balance. The gifts of a more technologically advanced culture to a more primitive one often include new materials which are more convenient or more readily available than the accustomed one, but which tend to destroy the natural balance of some traditional forms.

In applying the products we now produce, we must be aware of the full set of demands they make and be ready to meet them. A Navajo in Arizona was complaining that the new hogans with asphalt tile roofs were far less comfortable both in summer and winter than the old ones with their heavy adobe domelike roofs. The loss of building mass with its time component changed the environment of the structure.

The hogan no longer had a massive roof that delayed the penetration of the sun's heat until the cool evening or the mass that kept interior heat despite sudden drops of winter temperature.

WHAT TO DO

The first, most immediate adjustment in design is to conserve energy by designing the building as an object affected by sun, wind, rain, snow, lightness and darkness, determining when and where each is to be admitted or excluded. Bring the building as close to a natural balance with these forces as program, technology and skill will allow. Then make up the imbalances with mechanical interventions. In this sense, the building becomes an element among (even of) other elements —more than an isolated object.

Some equipment decisions affecting energy use without going into program or layout:

- Reuse and reclaim waste heat from exhaust systems and various processes. Cooling systems for walk-in refrigerators remove *large* quantities of heat. Exhausts from hoods and ranges contain heat that can be recaptured. Lights give off heat. Electric generators use only a small part of the heat to drive them, dumping the rest.
- Modular boilers can increase efficiency of steam production by 20 percent and more. Oversized boilers, designed to oper-

ate below peak, but with a safety reserve for a once a year cold spell, will operate most often at under 25 percent capacity. The efficiency is down by 20 percent at these times. By having two or more boilers sharing the load, each can operate closer to capacity when it is required, and with significant increase in efficiency.

• Electrically driven air conditioning equipment has varying efficiency ratios (kwhr's required per Btu of cooling). These vary by two to one or more. Checking equipment for energy efficiency is revealing.

• Terminal reheat can be avoided. Reheating cooled air to modulate temperature is wasteful on the face of it. Try variable volume systems.

• As controls are increased and zoning subdivides areas for control, energy use becomes more efficient since it can be called for only when and if it is required. This leads to certain contradictions in comparing centralized and decentralized systems. For example, while central air conditioning plants are more efficient than individual through-the-wall units, the fact that such units are turned on and off, space by space, can offset their mechanical inefficiency. Careful comparisons must be made.

Little attention has been paid to developing devices to reduce energy requirements of existing buildings; yet these are responsible for almost one third of our total energy use. We can identify how and where energy is being used unnecessarily and can even describe ways to curb these wastes. In many instances standard products are not available or designed for easy use. Among the things that can be done are the control of solar gain through sun control devices, use of reflective glazing and elimination of badly placed fenestration.

• Infiltration and connected heat transfer can be modified by double glazing, caulking, weatherstripping, or the application of various membranes. Thermal characteristics of exterior skins can be improved by adding insulation, or new layers of finish inside or out.

• On the interior of the building, reexamination of light levels, light delivery devices and the switching and control patterns can produce major reductions in electrical consumption.

• Most existing mechanical systems can appreciably improve their economy of energy use. The level of maintenance depends on trained personnel. Timely replacement of filters, adjustment of equipment, the setting of controls, the insulation of pipes and ducts, the curtailment of services to spaces that are not in use and similar prudent actions result from well informed maintenance attitudes.

In addition, many elements of mechanical systems can be replaced with more efficient ones. Cost-benefit analyses can justify many of these substitutions immediately. Normal replacement scheduling will often provide the opportunity for upgrading a system with no increase in the long term capital cost pattern.

Many of these suggestions depend on having available materials to do the work. It would be useful to have a system similar to an exterior scaffold that could be an adaptable sun shielding device for different orientations, sun conditions and window spacings. It would be also useful to have a reliable kit for injecting foam insulation in existing wall cavities of all sorts. This would ease loads if there were an available spray of a light colored or reflective coating specifically made for and easily applied to existing roofs, or a ventilating unit that can be cut into fixed glass installations. (The whole field of roof fitting could produce an interesting series of products and techniques with a tremendous potential market.)

Organizational Action

Encouraging things that are happening throughout the profession—not fast enough to assure that the architects will take full advantage of their potential for ameliorating the unfavorable energy situation, but certainly much more than would have been predicted 18 months ago.

• American Institute of Architecture Task Force on Energy Conservation has laid the ground work for more positive leadership in the field, including participation in several national research efforts of the Institute.

• Local chapters have developed committees that have participated in hearings, held meetings, written publications, designed exhibits and set up working relationships with sympathetic non-architectural groups.

• Cities, states and national government agencies have conducted and sponsored research, published material and begun to use their regulatory powers to see that energy use in building is reduced. Among those from my own experience (by no means a comprehensive list) are New York City, New York State, Minnesota, Rhode Island, Wisconsin, Seattle and such federal agencies as the General Services Administration, the Government Accounting Office, the National Science Foundation, and the National Bureau of Standards.

• Architectural schools throughout the country are developing curricula and sponsoring talks and meetings: Among them MIT, Columbia, City College of New York, Ohio State, Minnesota, Wisconsin, Pennsylvania, University of Arizona, University of New Mexico.

• Groups interested in special building types have begun investigations in their own areas —for example, regional meetings have been conducted by educational facility planners, as well as national meetings of urban school planners.

• Manufacturers of building materials are beginning to assess the relationship between their products and energy use. Production of more energy efficient products has begun in mechanical fields, lighting and thermal performance. There also has been a trickle of useful information (hopefully to increase) and a great amount of advertising with such evocative words as Ecology, Environment and Energy Crisis in large type.

• The non-architectural press along with the radio and television networks have devoted a great deal of time and space to the architectural aspects of the energy problem.

• Our allied professionals, in their organizations and committees, have begun assessing the manner in which they can affect energy use. So have the American Association for the Advancement of Science and the National Academy of Sciences.

This list is not intended to be comprehensive. It does suggest, however, that the energy issue is of wide concern. And there is already a network for the development, exchange and publication of information.

ARCHITECTURE ON TRIAL

We are beginning to see a number of experimental buildings designed to be as independent as possible of outside utilities and energy sources. Houses have been designed, or are being designed, to take advantage of solar heat for both water and space heating, to use wind for electric generation, or use methane gas from sewage digestion as a fuel and minimize waste with its attendant pumps and equipment. These include the Zomeworks people in Albuquerque, Richard Blazej's development in Vermont, Graham Caine's experimental house in England, the solar experiments at the University of Pennsylvania and others. MIT has a number of solar heated houses built and analyzed. It should be pointed out that although these projects have been brought up in the context of energy conservation, they all suggest answers or alternatives to most of our other environmental problems as well.

Something called "the house for the natural man" by its designer, Graham Caine, a London architectural student, is now being built. Mr. Caine intends to live in it for two years while testing its systems. The house and greenhouse combination is designed to produce its own fuels for heating and cooking, collect its own washing and drinking water, grow its own food and recycle its own wastes.

The core of the house's systems is the sewage digestion plant which converts all organic wastes into methane gas for cooking and liquid nutrients for the greenhouse, where vegetables and fruit will be grown by hydroponics agriculture. A solar heat system will provide space and water heating. Water will come from a roof rain collector. In order to work, this system presupposes a great deal of economy in the use of its facilities. Caine is also a vegetarian, which helps. The house is admittedly experimental, and there will be standby power and water available if needed. However, should it all work, the only outside power necessary will be electricity for lighting and supplementary heat.

And Caine intends to bypass this by also adding a wind-powered generator and power storage system later on.

There are several studies in process attempting to provide firmer data than is now available. Some, such as the GSA Office Building in Manchester, New Hampshire, take the form of a building designed specifically to be energy conserving.

Our office is now discussing the possibility of a similar research building and evaluation project for the New York City Board of Education.

Following a period of research (technical in regard to energy use systems and performance, programmatic in reinvestigating the energy use required by the activities to be housed), the building will be done with monitoring and recording instrumentation built in. There will be a two-year evaluation period based on monitoring the energy consumption after the building is in operation. And the project will have the support of several Federal agencies as well as that of the City.

The interesting observation suggested by these experiments is that the new look at energy use results in an expansion rather than a contraction of the building vocabulary. It becomes apparent that there is no single answer to the complex problem we are facing, and that the overall solution takes advantage of many varied, dissimilar methods. What is suitable in New Mexico may not be suitable in Vermont. Yet there is no reason to dismiss it as unimportant. The amount of sunlit hours in New York, compared with Southern Arizona, does not mean that solar energy ought to be disregarded in New York.

It will be useful to learn more about the successes and failures of the various proposals now being carried out.

Stating the problem and pointing out the possibility of coping with it in no way assures that the necessary steps will be taken in time or, in fact, at all.

There are strong counter-pressures. As a national characteristic, we prefer to provide large scale, generalized solutions that operate far below their potentials in order to have the high performance capability that will occasionally be required, rather than specifically identifying those occasional peak demand requirements.

Examples are all too familiar. The 400 horsepower car. The indiscriminately high light levels over the whole floor of an office building. The one switch that turns a whole floor on or off. The structural beam that is unchanged in cross-section from one end to the other. The glass facade that introduces light uniformly over its entire face. The same facade that excludes air uniformly. The Music Hall Rockettes. The broad area spraying of DDT. The same buildings springing up in Montreal, New Orleans and Paris.

The result of this lack of specificity is a deterioration in the quality of life at the same time that there is some increase in its physical abundance. Changing the delivery pattern to one that responds to clearly identified needs and problems has economic benefits as well as psychological benefits in economic terms.

By being specific in application, energy use may be reduced by 25 percent to do the same tasks it is now called on to perform. The improved sense of tautness and precision in our full environment, however, may be an equally important result of these reinvestigations.

Even if energy were suddenly abundant (an unlikely supposition), I believe its consciously limited, precise use would bring our architecture back in to the historic stream of great architecture of the past. Five years ago it was possible to advocate the intelligent, controlled use of resources and materials as a matter of choice. For the period immediately ahead of us it becomes one of necessity.

There is also a momentum in the present industrial and commercial commitments that tends to perpetuate the familiar form of architecture and building. Many forms, materials and assemblies will have to be phased out of building lines and catalogues. Just as the utilities have found it necessary to disband their sales promotion forces and develop educational programs on better use of their products, so will the manufacturers and suppliers of building components.

Over the past several decades, with increased stress on reducing building site labor, there has been the parallel increase in generalized solutions. We may now require a reevaluation of how our buildings are erected. We may need greater craftsmanship on the site, more trained construction workers. Unemployment in the building trades unions has resulted in restrictive entrance practices. In reality, there are many persons, particularly in minority groups, who are unemployed or underemployed and who would be most eager to enter the construction field. Our present procedures reflect and depend on an unlimited abundance of inexpensive energy. The situation never really pertained. The illusion does not, any longer.

Although there is a nominal commitment to efficient planning in the profession, there are too many structures that are wastefully planned. If more efficient planning reduces the area that will require heating and cooling, it is an obvious method of reducing energy consumption. We can look at many of the award winning buildings in the architectural press and realize that energy utilization or plain efficiency had little bearing on the solution.

The architect is the one person in the building design team who can make a comprehensive decision, synthesizing the various requirements of owner, engineer, site, orientation, budget, energy analysis and esthetics. He can be assisted with data developed by all his consultants, by computer analyses and simulations, and by tentative trial solutions. Since all the requirements are intimately related to the use-value of the building, the architect's energy-based decisions become extraordinarily complex.

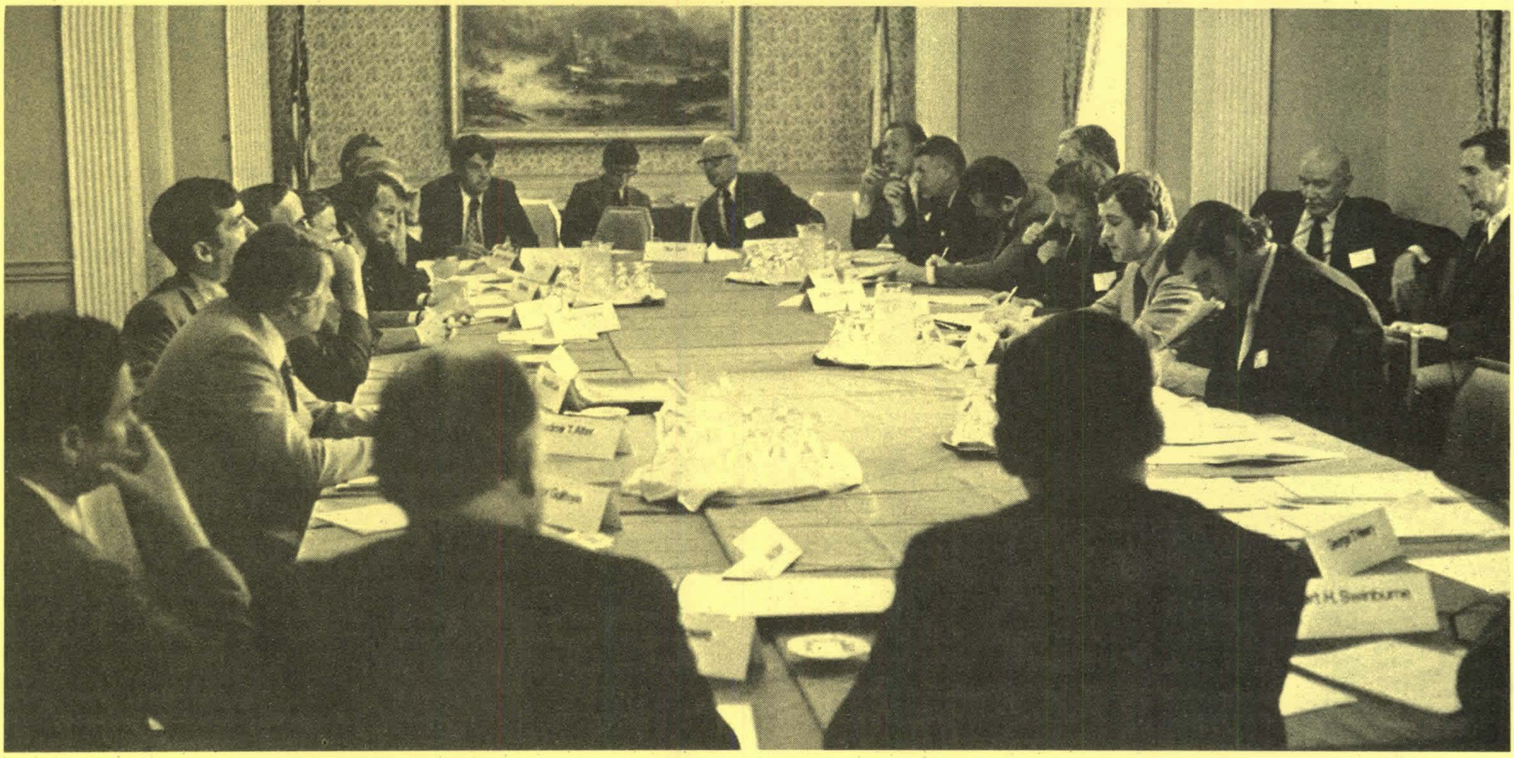
The architectural profession needs a framework in which the energy values of different materials and assemblies are listed. Its use would permit choice of equally adequate materials based on the energy impact in manufacturing each of them. Such a framework would also establish the tradeoffs between energy required in the production of a material and energy required in the operation of the finished building. My office expects to prepare such a framework in connection with the AIA Task Force on Energy.

A new evaluating technique must be developed that considers the energy implications of extending the life of a structure or demolishing it. In addition to the purely economic considerations, there are many structures in existence, the result of measurable energy inputs, that can continue to serve needs usefully. The architect must learn the techniques of reuse, the modifications necessary, the method of upgrading the performance of mechanical systems and the useful incorporation of existing space in new projects where energy savings would result. At various levels, frames, total structures, exterior closures, interior partitions and mechanical systems can be reused.

The experience of Dr. Lawrence—New York City's utility expert on the survey which revealed seven to one differences in energy use in the most extreme post-World War II office buildings—leads to the desirability of determining a theoretical energy use index for all buildings designed. If the index is at sharp variance with the building's, it would call for reinvestigating to establish whether the causes for the special condition were justified.

Bringing the whole question back into perspective, I believe it is necessary to stress one thing. Energy use is a means to accomplish certain tasks that are related to human survival and comfort. It cannot be considered as having an existence apart from what it permits us to do. These tasks are extensive and worldwide and their needs, rather than trend projections, should establish energy growth. In view of their urgency we cannot afford the squandering of energy use. The architectural profession, its decisions and products determine about a third of all our energy use, of which a quarter may be unnecessarily expended. An architecture responsive to the physical universe and our infinitely varying human requirements may indeed be an architecture of heightened inherent quality and one that diminishes the damaging impact of the present energy crisis.

PHOTOGRAPHS: Page 39, Charles Harrison; 41, Bettmann Archive (top), Carl Stein (center): 42, Wide World Photos; 47, UPI (center) Phipps (bottom); 49, Thomas Nittner (top), Carl Stein (bottom), Bettmann Archive (left); 55, Smithsonian Institution.



FORUM: ENERGY'S IMPACT ON ARCHITECTURE

On June 18, 1973 The Whitney Group of Design Publications sponsored this meeting of leading spokesmen in the building industry.

MR. VLADIMIR ALTER
Vice President
Kawneer Company of Canada Ltd.

MR. MacDONALD BECKET, AIA.
President
Welton Becket and Associates

MR. GEORGE B. BEGG
Special Assistant to Mr. Meisen
Public Buildings Service
General Services Administration

MR. GEORGE W. CLARK
Engineering Manager/Special Projects
GTE Sylvania, Inc.

MR. LEO A. DALY, FAIA.
President
Leo A. Daly Company

MR. ARTHUR W. DIEMER
President
CC&F Property Management Company

MR. BRUCE GLIDDEN
Vice President, Engineering
American Bridge Division
United States Steel Corporation

Ms. OLGA GUEFT
Editor
Interiors

MR. J. ROGER GUILFOYLE
Editor
Industrial Design

MR. GEORGE T. HEERY, AIA.
President
Heery & Heery

MR. GERALD D. HINES
President
Gerald D. Hines Interests

MR. ROBERT H. HOWE
President
Real Estate and Construction
International Business Machines Corp.

MR. R. D. KUPFER
Senior Vice President
Turner Construction Company

MR. WARREN T. LINDQUIST
Associate of David Rockefeller

MR. B. MALLORY LONG
Vice President, Marketing
Inland-Ryerson Construction Products

MR. OTIS MADER
President
Alcoa Building Industries
Aluminum Company of America

MR. WILLIAM MARLIN
Editor-in-Chief
The Architectural Forum

MR. WALTER A. MEISEN
Assistant Commissioner for
Construction Management
Public Buildings Service
General Services Administration

MR. C. E. PECK
Group Vice President
Owens-Corning Fiberglas Corporation

MR. JOHN H.K. SHANNAHAN
President
Electric Energy Association

MR. ROBERT E. SHEPHERD
Director
Office of Energy Programs
U.S. Department of Commerce

MR. JERRY L. SMITH
Manager of Technical Services
Libbey-Owens-Ford Company

MR. ROGER D. SPENCER
Director of Marketing
Glass Division
PPG Industries, Inc.

MR. JAMES A. STEWART
Senior Vice President
Travelers Insurance Companies

MR. HERBERT SWINBURNE, FAIA.
Partner
Nolen Swinburne and Associates

MR. WALTER W. TREICHLER
Manager of Market Development
Machinery and Systems Division
Carrier Air Conditioning Company

MR. CHARLES E. WHITNEY
President
Whitney Publications

MR. MARLIN: This is The FORUM's first Round Table in some years and, in that respect, revives one of our magazine's most important traditions.

The discussion at hand, given over to the energy question, should be looked upon as a restatement of The FORUM's desire to carry on instructive dialogue with responsible spokesmen of the design, development and building industries. Indeed, of our determination to be more than a magazine, a catalyst for such dialogue, dealing with several areas of effort in this ever-broadening field.

Dr. Buckminster Fuller once defined a poet as one who can capture cosmic truths in a compact, compelling way. In line with his definition, I would say that Dr. Fuller is probably right in describing Albert Einstein as the greatest poet of the Twentieth Century, for that famous equation, $E = Mc^2$ is about as compact and cosmic as you can get.

Taking off from this, I think it can be said that the experience and viewpoints brought up in this meeting today will, though varied, have at least one important objective in common, namely, getting the most efficient performance out of every increment of input—whatever the source of that input turns out to be.

We are long past the point of spending our time and our energy castigating past failings. Rather, we must reassess the structure of our cultural values, the structure of decision-making, the structure of the design and building process—certainly the structure of our long-held concept of "cost," of what we can or cannot afford.

We are at a point that we cannot afford *not* to undertake such reassessment, and it is in that spirit that we meet. It is in that spirit that we begin what I hope will be a spontaneous give-and-take about a subject which has become, need it be said, the most crucial factor facing world society, and especially the acquisitive, enterprising society of the United States.

Those involved in this discussion represent some of the best instincts of the corporate and governmental sectors, people who understand that energy is the element by which all other elements cohere and by which they function, and people

Meisen

who understand that without a coherent governmental energy policy, society cannot hope to remain dynamic and productive. In our quest for sources of energy, in our effort to stretch the sources we have, we must not be caught up in just new technology. Old assumptions will have to be modified. Vested interests will have to be unbuttoned a bit and fresh new attitudes embraced.

MR. SHEPHERD: I can summarize the government's stance by quoting a doctor friend of mine, who said that another doctor came to him the other day, asking if he could lower his sex drive. While expressing some amazement, he said, "Well, Doctor, right now it's all in my head."

The point is that we do have energy problems, and in the United States we are in a situation where our domestic demand for energy is far outstripping our current domestic ability to supply it.

This is causing two different kinds of problems—one stemming from the fact that America's energy distribution system was developed to run on a surplus, however slight. The dividend of this is that parts of the country are going to run short of certain types of energy during the course of this year, probably no matter what we do.

The other thing that is happening partly as a result of this old-line policy, is that energy costs and energy prices are going up.

The Federal Government has embarked on a fairly ambitious program, as outlined in the President's energy message of 1971, and more recently of April 18th. Very briefly, that message and program call for measures to stimulate the production of domestic energy of all forms, a new program to import what we need that we can't produce ourselves, and a call for energy conservation.

I think that the point most important for this group today is the call for energy conservation. That energy message has been criticized by some for not placing enough emphasis on this aspect of the energy situation today. I think that that is remedied by the President's second energy message of June and will certainly be remedied by a series of broad government actions to stimulate energy conservation.

MR. MEISEN: Our approach at the General Services Administration has taken two major directions. First off, however, I don't think it is fair to say that to conserve energy automatically means that you stop wasting energy. I think that the concept of "waste" is a better one, because we do, in fact, indulge in considerable waste.

Our goals have not been to alter life-style, or reduce lighting levels *per se*, such as reducing air conditioning to 78 or 80 degrees. Instead, we find out what we can do to maintain those *characteristics* of an air conditioned building—good lighting, for example, and yet stop wasting what we have.

The GSA tried out some ideas in the design of a building in Manchester, New Hampshire, which is designed to be an energy conservation laboratory in a sense. One of the earliest things we did was to set up a program for analyzing energy use and where it goes in a building—this in cooperation with the Bureau of Standards.

We hopefully want to save about 20 percent of the energy used in a typical office building and maintain normal life styles. Our initial run indicates that just by the orientation and fenestration in a building, you can save probably up to 40 percent of the energy—just by proper orientation and planning without even talking about the mechanical-electrical systems.

The second was, of course, stop wasting energy in existing buildings. We already have an inventory, some 10,000 buildings in GSA alone. No matter what we do in new buildings, we obviously have a pretty vast reservoir of potential savings in existing ones. Just recently we started a program to conserve in greater quantity, and maybe find some more dramatic, snazzy ways of delamping fixtures.

If you assume that many of the fixtures we have in buildings are flexible rather than for specific one-at-a-time tasks, it stands to reason that many of those fixtures are not being used at any given time for task seeing. We anticipate that we can, in fact, turn off about half of the lamps in these 10,000 buildings and not affect task vision currently available in them.

MR. PECK: I feel strongly that we are here because we do have the skills to reduce the amount of energy that is going into the buildings we are building today. Certainly 30 percent, probably 50 percent, on most commercial buildings.

Beyond the scale of the individual building, as each of you would say before I would, these buildings become *communities,* and how the buildings are planned and located related to transportation, related to employment, related to how the whole community works, can probably have an even bigger impact on the energy wastage than just the air conditioning and certain technical hang-ups.

We should focus on things that we can *do.* I hope we don't spend too much time on the Alaska pipeline or the offshore drilling, et cetera, because the truth is that America is going to have to do some or all of these things to overcome the energy problem.

If I understand it right, the Office of Science and Technology has said that 14.4 percent of the nation's energy in 1968 went for commercial uses, as distinct from residential, industrial and transportation uses.

At that point in time, it was 8,770 trillion Btu's. My own guess is that will double by 1978 if we don't do something about it. Our target is to reduce those wasted Btu's.

I hope we discuss how to get owners and financial people to make higher first-cost investments to get energy-efficient buildings. I hope we can spend some time on how to make life-cycle costing a realistic analytical tool for the owner and the financial people, and how to have the typical building designed to an energy budget, or at least to have it request energy options for the owner.

I wonder how we could get producers to bring the knowledge that they have, if not in their sales force, in their technical people or in their laboratory, to the table at the right time when the tradeoffs are being made.

I wonder how we could get the producers to bring to the market more efficient energy and devices and equipment which can be put to work as tools for industry.

I personally hope we also talk about solar energy solutions, total energy systems, and the impact of energy resulting from community planning.

MR. MARLIN: Before we launch into a general discussion and roll up our sleeves, I would like to hear a few words from the man who is chairing the AIA task force on energy conservation, Mr. Leo Daly, who is, of course, president of Leo A. Daly Company, based in Omaha, but it seems, lately, based just about everywhere else.

Mr. Daly first came to my attention a number of years ago, not so much as a leader in the design and building field, which he is, but a man who has one of the finest art collections in the world.

MR. DALY: The AIA, some 12 months ago, established a task force on energy conservation. Two of the five members are here today.

It is our feeling that any change in the law, regulations, ordinances or standards should come after a period of intense study and should be based on facts. The facts that we need are not presently available.

I recently engaged in testimony on the House committee. And at that time I tried to outline what we've discovered *thus* far. Generally, it is that we must develop new sources of energy. But the sources that we develop must be clean ones.

Somewhere I read that the United States wastes more energy than any other nation in the world uses. And that probably is not far from true.

If we develop new methods of producing energy or utilizing energy, the mere production of more energy will not only fail to solve our problems, but it will increase them. We have to focus our attention on the fact that the energy problem and the environmental problem are on a collision course. We have to find some way of marrying those two areas of concern.

Somewhere in the neighborhood of a third of the energy used in the United States is used in heating, ventilating, air conditioning, lighting and other functional systems that make up a building.

These systems are all designed by architects, engineers and allied professions. Now we should be able to do something about that. You can find figures that anywhere from 20 to 50 percent of the energy used in our present buildings could be conserved with proper attention.

So it would behoove everybody in the design professions, and in the manufacture of goods and materials that go into buildings, to take a close look at this and decide to make the effort. We have to devise methods to study this problem enough to come up with some hard data that we can base some rules and regulations on.

Certainly I don't want to leave the impression that we think that only changes in regulation, ordinance and code can bring about design changes. There are other ways of changing people. And this is where it all starts. Education is one of them. The work that all of the professional societies do is another method.

Gueft

So at the present time the American Institute of Architects is trying to work with the Bureau of Standards to take a leadership role in calling a conference of all of the disciplines involved in the design of the building environment, as well as the people involved in the manufacture of building products, to try to get down some guide rules and arrive at some sort of an action plan where we can come up with the facts that we need to decide what steps should be done to more intelligently approach the energy conservation program.

We hope to be able to authorize knowledgeable people in all the various fields of design and production of products to prepare papers on the areas that have to be looked at and studied intensively if we are going to arrive at any sort of a coordinated plan. Late this year, or early next, we will have an action program that everybody in the construction industry will get —and hopefully get behind.

MR. MARLIN: Thank you. I would like, at this point, to throw out any sense of formality and parliamentary procedure and have some spontaneous discussion about the basic points brought out in these four prefacing statements.

MS. GUEFT: 20 years ago, before Ada Louise Huxtable began to write about how horribly we are designing buildings so that fortresses had to be air conditioned, (they are made out of glass so that they become pressure cookers), but before that, well before that, even before Bernard Rudolfsky did a show at the Museum of Modern Art on vernacular architecture, we did an issue of INTERIORS on climate control. Our theme was introduced by a picture of a beautiful primavera-type dame who stood for nature and a picture of a dragon. And our headline was, "Nature, Friend or Foe?"

That was the essential question. Mind you, this was before there was an energy crisis. And this was before our offices were air conditioned and we sweltered in the summer.

The issue was full of pictures of shapes of houses, showing how air moves through a building. It was full of the most elementary primitive ways that have been used to control climate indigenously.

Before there was all this energy that we could use, before we had the technological means to take a box and give it the climate that was available and when the population of the world was essentially poor and had to make itself comfortable with the means it had at hand, what did people do?

As a matter of fact, the form of regional variation in architecture evolves from precisely that. You have the sloping roof in snow country. You have snug low spaces in cold countries. You have high ceiling vaulted rooms in the hot countries. And all of this doesn't make you absolutely as comfortable as you are in an air conditioned parlor.

There are times in an Alpine house when I suppose you are too cold and when you wish you didn't have that load of snow just beyond the door. But still, the fact is that mankind has always been able to control his climate fairly decently without using this tremendous amount of energy for air conditioning, and for heating.

There are ways of doing it with architectural form. And one of the facts about the international movement's unanimity, that buildings now are the same, no matter where they are, is due to the way we ignore the climate. We ignore the physical condition, we make the house we want to make, and then we correct what we've done wrong in design.

The construction industry has a tremendous vested interest in doing things the way it is doing things.

That is going to be very hard to change. Sure, we can build houses the way they did 3,000 years ago. But, if so, a lot of big industries are going to have to revise themselves and, heck, maybe stop what they are doing and do something completely different.

We realize that the energy problem is the same as the environmental problem, is the same as the ecology problem. All of these things are essentially *one* problem. The question is of control. It's horribly different. I am sure you say the government has got to step in and then you say politics, but look at the Soviet Union. Have they solved environmental problems? So, what kind of control is necessary.

If you build the way the Greek fishermen built houses, with small holes at one wall and larger holes or windows at the opposite wall, they automatically got an air movement.

Now, admittedly, it doesn't always work quite as well as air conditioning, but it *is* an example of what you can do if you don't want to waste energy. So the design profession must ask itself: Are we going to tell the construction industry and the government and the oil industry and the automobile industry what to do?

Certainly the design profession has gotten nowhere with the automobile industry. Until things get desperate, nobody listens.

MR. HINES: Excuse me for taking a point of difference, but that is really unrealistic. I think our system is basically demand-driven. One such demand is comfort.

You are not going to turn people back except by the legislative process. And I don't believe today that you are going to turn people back 100 years or 50 years.

MS. GUEFT: I agree.

MR. HINES: So basically the situation is, within a comfort level, that our citizens are going to dictate, once they work the 74, 75 degrees and hold those comfort conditions and have a vista that they can look at in terms of their work environment, these are things that they demand as a minimal level of comfort or esthetics. And I think that in our presently fragmented unit industry, in terms of the demand relationship, it isn't just a matter of how it is implemented in design; no, I disagree.

I am not sure that the architects do know how to do it yet. I think this is where we have fragmentation. We have fragmentation in our design-construction-operation process, which has not yet been bridged as it has in the automobile industry, where we have, under one source, the basic tools of design, implementation and manufacture.

We are coming closer to it. But I don't believe we have the same types of feedback as we had in other industries. Probably the greatest force that exists for change, recognizing life style, lies with the financing sources. This is one that the builder or owner will always listen to because he must have money to build.

At this point, there is no recognition in that industry of need for a look at operating costs. And except for a very few, very long-term holders of real estate (and those are maybe 15 percent of the market), the balance of the market must take, and most structures are built to be sold within a three-year period after completion.

So there is a very heavy demand to stress first cost, as opposed to long-term operating costs.

I have talked to a lot of life insurance companies that we have dealt with, and they don't have the resources to look at the life cycle costs of a property, which is a major increment in their investment. Then you have the most escalating cost of all, which is energy, compounding that. We have looked at some figures showing horsepower per square foot, the cost of our energy, because we hope to be in a much more competitive position than our competitors three years down the line.

Even though the industry passes on these excess costs, it is a factor that you assume that you are going to be more competitive at some future date. But we are a very fractionalized industry at this point in terms of communication and how products are manufactured. There are multiple sources of manufacturing, lacking communication. And that is one of the major reasons that we have this fantastic energy absorption.

MS. GUEFT: However, complicated and fragmented the industry is, there are times when a client is very much in position to decide things.

Certainly we have just heard from Mr. Peck that the commercial sector absorbs a great part of our energy output. A big office building, which is built as it is today, is as a glass sun furnace. Air conditioning becomes rather an arbitrary decision which the architect and the client control together.

MR. HINES: It is demand-driven because of the consumer himself, who says, "I want X percent of glass." Now we can use reflecting glass which gets down to a part 35-U factor in terms of the insulating value. It has maybe a high-shading coefficient. These are the factors of *livability*. It isn't a furnace any longer. And I think that is what happened. I can remember ten years ago when we went and cut the amount of glass to less than ten percent of the exposed surface because we were looking at our operating costs. But the livability of that space was so reduced that the tenant did not

Diemer

want to pay for one that wasn't glassed, that didn't have views.

In Europe you have to put in the very best air conditioning to get people away from natural ventilation. But they are also coming to a major controlled environment and employment where you have an undersupply of skilled people.

It is going to be the crucial demand factor to get your buildings occupied. So that is really the control factor that you have to operate under. And that's why it is driven by demand, demand of the occupants.

MR. DEIMER: We could probably spend several days of details on what mechanical system is the best system and the most efficient system, and so on.

But I wonder whether the basic question we should be asking ourselves this morning is: Who must spearhead this conservation of energy? Someone mentioned the design industry, the architect-engineer. Someone might say it would be government-instituted controls to force the designer to use certain new factors.

Another person might say, well, why shouldn't it be the producers? These are the people that have something to gain. They can come up with a product that will be using less energy and then someone might say, "Well, why isn't it the owner?" And Jerry Hines and I are somewhat in the same boat. We want to be extremely competitive amongst our developers or else we are not going to be in business very long.

I happen to know that the architect - engineer is not capable of spearheading this, because he does not have the resources to do it. Normally, an architect-engineer gets a fee from a client which is based on a percentage of construction costs. And the developer often looks for the lowest fee possible from a qualified designer.

The architect really doesn't have his fee structure set up for anything like research or designing new systems. The only way he can maximize is by cranking out the same old system by the dozens because his design staff knows, and I am speaking now primarily to the engineer rather than the architect, it's an assembly line production. This is how he maximizes his profits. He does not have sufficient fee to do basic research.

The owner does not have those financial resources either, although he can give feedback to the industry. The producers, certainly — they are usually larger corporations who have greater financial resources, laboratories for basic and applied research. Perhaps this is where I first begin to see some light as to who should be doing the largest amount of research in this area.

MR. SHEPHERD: By a producer, do you mean an energy-producing company?

MR. DEIMER: That, or a company like PPG for example. And then last is the government.

MR. MEISEN: I find myself in a somewhat enviable position in that I represent government and I also represent about a thousand design professionals.

We represent, in many respects, three major factors that *you* talked about, being an owner, designer *and* government. I would hate to think that we are going to lean on government to solve this problem, because I don't think it can be done by legislation.

I am convinced that the owner has to play the key role. I think he has to demand a certain service. I am tired of hearing that the construction industry or the producers are unresponsive. I found them just the contrary. They have played the game according to the rules that have been laid down. And the rules are laid down by the design professionals and, primarily, the owners. I say that because they're the ones that really have the money, not for the research maybe, but they're the ones that are buying all these products.

If you don't believe that is so, try doing it without the guy with the money. The real problem is that design professionals, on one hand, have not given all of the options to the owner.

Ninety percent of the design decisions made in an office building today are not given to the owner as an option. They are given just as you would in the safety factor. No one would think to give a choice to an owner whether this building is safe or not. How much you pay for lighting and how much air conditioning you get is not left up to the owner, except for the really progressive owners who do a lot of it.

They interject almost above the profession. They insist on it to the point where you will often hear professionals say, "Well, he is one of those commercial guys who dictate a cheap building."

This is really feedback coming from an owner saying, "This is what I want." It has to be a demand on the part of the buyer.

Now, the producer cannot do it on his own. In no way. He has been encouraged by a competitive bid system, using specifications to build not necessarily the most efficient equipment he can, but the most inexpensive.

When I say a design professional shows a lighting layout in an office building, I am telling the producer that I want a light every place I showed one. And whether your light is twice as efficient or not doesn't matter. I need 40 lights in this space.

So his whole incentive is to go to the cheapest lighting fixture he can because he has to put 40 lights in; and if his light is twice as efficient, still 40 lights.

We have to get back and reach the producer on a *performance* level. Give him the latitude that if he produces a more efficient product, allow him to use less of it. In other words, if you have a light fixture that can give you twice as much light, let him put in half as many fixtures. But we haven't done that in our normal way of specifying buildings.

You need performance. But we have gone along as though it's "unpatriotic" *not* to use energy. If you came out and said, "I am going to give you a little better motor; it's going to cost you twice as much in energy"—those years when Consolidated Edison used to have a little man standing there saying, "Are you using your energy today?"—it's almost like you *had* to use it.

We have to get away from first cost, although I am convinced we can save up to 30 percent without even changing first cost. But we have to allow the latitude of life cycle costing.

We talked about bringing in the mortgage owners. As long as you are selling a building in three years, it's awfully hard to talk life cycle cost to an owner, especially the commercial owner who's in it for rapid turnover, for cash flow.

Even so, the owner has to put in the drive, and be shown reasons why that drive can pay off. He has to insist on options from the designer. The designer, while responding to those options, must ride this performance criterion for all it's worth, doing so in such a way that industry can get convincing options to be efficient.

The designer cannot just say how to solve this or that technical problem. He must say what it is and how a solution relates to what desired performance. Unless the designer does that, he will not be able to make any great impact.

MR. LINDQUIST: While we are getting the problems on the table, I would like to raise just one more.

But the owner is apprehensive about making an investment in any method which may make his whole building uneconomic. Although that particular increment of the building cost may not be a controlling one, if he tries to use a new method, and the damned thing doesn't work, he's got a problem almost impossible to cure.

I don't have the solution, but maybe my friend, Mr. Meisen from the government, can take

Lindquist

some risk which the ordinary owner won't take. When he has demonstrated in some of his buildings that those risks are economical and will work, maybe other people can try them.

Another problem I would like to mention is the conservation of energy. If the designer would just design the designs which they know how to design and design them right, it is not a matter of new technology. It is getting existing technology properly designed. If the people who are going to operate it would have the capacity to see that it is correctly maintained over a long period of time, you can save an awful lot of money.

We know how to design air conditioning for an office building. Yet how many air conditioners are terribly inefficient because of faulty design?

Thinking in terms of not only money cost but of energy cost, the reason the money cost is there is because the energy cost is there, because of energy consumption.

MR. DALY: Which is the most important in your mind?

MR. LINDQUIST: The money cost, but I don't think you can separate it from the energy cost. I happen to be associated with the people that build homes. And we are terribly concerned, naturally, about the long-term operating cost of the building because we recognize that there is very apt to be inflation.

Costs are going to continue to go up. Therefore we are never going to be able to build more cheaply than we can today. We want to build as economically as we can, but we also want to build in long-term economies. That way we stand a good chance of being in a competitive position, vis-a-vis other office building competitors, ten years down the road.

MR. SHEPHERD: What sort of percentage does anybody have between building types in this country?

MR. HINES: If you are talking about apartment projects or commercial types of projects, I would say it's in the ten to 20 percent area. That's not taking institutional type clients, such as government. But the majority of what is termed investment building is normally for a term. And, of course, you get back to the point I made. The original owner-builder may sell.

But when he sells, he passes on the risk of whether that product is going to face the market place and be occupied. At that juncture, it really lies with the insurance company. They, at the same time, hope rents have normally increased and that the efficiencies of whether that is going to cost an extra 20 cents in square feet to maintain and operate. They will hope that half of that amount, at least, is covered with inflationary rents, and that they don't have a foreclosure.

But I think this is a critical item in the control point. Again, it is fractionalized throughout hundreds of insurance companies throughout the country.

MR. DALY: There is a group of factors entering into the design and operation of the environment. One of them is money. A second one is energy. If you have plenty of energy, then you can say money is more important. But if you don't have any energy, and New York is facing up to some of these problems, then you might say that is becoming more important. Sometime you might cross that line where energy will become more important than the return of your investment, and you will have to expend more money to conserve the energy.

What the design professions are trying to say is that in conjunction with an owner, and many times on our own, we *can* originate change in the rest of the building industry. Our function is, in this regard, a simple, strategic place to generate change, but we can't generate everything, and certainly not in isolation.

MR. SWINBURNE: Let me cut in here, if I may. I just heard that we are in that very fortunate group that are not able to do anything about this energy crisis in terms of leadership. Only as a participant.

May I suggest that we are discussing leadership, and some conflict of interest.

Someone said it, I don't recall his name, that what this country needs is a good ten day blackout. If it comes, maybe we would not design tomorrow

Swinburne

morning at nine o'clock like we are doing this afternoon at three. I have an office policy in my firm relating to energy. It has changed my practice in the last two years and relates to similar policy in the areas of environmental impacts, life safety, and subsystems development.

Remember that design decisions by architects and engineers influence one-third of all energy consumption in America. This Btu reservoir, and my statistics say it is 70 Btu, will no longer be available to the design profession. The scarcity and accelerating cost of Btu units spread over long periods of operational years will positively change the economics of design.

Design concepts that generate low initial construction cost will give way to design concerned with life cycle operational costs with low energy construction.

Buildings can be built today that reduce energy consumption by one-half. Regulatory agencies will set arbitrary limits on energy for lighting, heating and cooling. Whether we like it or not, it is on its way.

The standards for human comfort, thermally and visually, will be reexamined. Accepted life styles will be modified.

Now this is not a facetious statement: water beds today, thermal beds tomorrow. So when we consider the microenvironment period, maybe it will heat up the whole house or stay uncomfortably warm on a cold winter night.

Environmental impact statements today, energy impact statements tomorrow, by requirement. Solar energy for tomorrow's house will drastically change its architectural design.

Economically not feasible today, comparatively inexpensive tomorrow. Today we talk of an energy crisis. And surely tomorrow there will be a water crisis. I say these twins go hand in hand. You cannot speak of energy conservation without considering water conservation. As soon as you solve your energy problem, you won't have any water around to do this.

My problem is that I don't think I know what you are doing. My problem is that I can't find a client that wants to let me alone or turn me loose.

What is the real problem of energy conservation? We have in my office a list of innovative designs that will conserve energy. The problem is not so much one of identifying those technical methods of reducing energy consumption as it is to identify those barriers preventing transfer of innovative concept to use by diverse institutions in the building industry.

A milestone in my life was when I sat with Leo Daly's group down in Washington and said I could never design a building today like I did yesterday. It's impossible. I am conditioned by my education and my design attitudes—so I want little holes on one side of the building and big holes on the other. This is one of the attitudes one has to change.

I think that The FORUM's greatest contribution—I am not sure you can design leadership yet, but you are on your way—the greatest contribution would be to expose these conflicts and pinpoint the guys who are really holding us up. If it's me as a design professional, *say* so. On the other hand, if it's the owner, let him have it. And if labor is tying us up, and I don't think they will be if the communication process is right, we are going to get hand-driven systems down here without conflict.

One of the things that I think America needs to understand is that our whole pattern of life is incredibly mobile. About 25 percent of us move every year! Think of the energy that's put into this.

Let's not make a design decision or an owner-producer decision or any other decision without fully recognizing the barriers that we are going to contend with.

MR. MARLIN: George Heery, how does your experience compare?

MR. HEERY: I would have to disagree with what Mr. Swinburne just said. I believe it would be well if we could destroy the notion that conserving energy in a building utilizing present technology necessarily costs more in the first place.

It's been my opinion for some time, particularly in regard to the typical highrise office building as compared to the current high-fashion designs we seem to be turning out, that there can be substantial reductions in energy use, obviously by reducing operating costs, but also by reducing original costs.

This doesn't mean that one part of the building may not cost more, let's say more insulation than we are currently spending. But when all of these systems are taken into account —including, to a large degree, the architectural concept of the building in the first place—there can be a significant reduction of both kinds of cost.

Once we have learned to deal with reducing energy in the buildings, utilizing our present state of technology, I have no doubt that we can further reduce energy in what I would call a second level of effort that will then undoubtedly increase original costs but further reduce operating costs. By that time, I believe that most of Mr. Hines' financial sources will have been so battered about by the energy crisis that we are going to have that problem kind of solve itself.

I certainly agree with Mr. Hines that it is not practical to believe we are going to voluntarily and, particularly without much leadership, solve these problems. We are going to face some sort of controls.

On the AIA task force we are approaching, gingerly I might say, the prospect of some kind of recommendations relating to standards. I would also agree, as Ms. Gueft pointed out, that while architects' designs have some knowledge, they don't have full knowledge. There is not a unanimity of direction among the design profession.

Nature, once friendly, has been so offended by man, primarily by the automobile, that urban America is now caught up in keeping nature out, or from getting even.

We were cautioned earlier to talk about buildings. But I can't discuss energy without pointing out that the automobile is *the* offender. Not necessarily the offender of energy but the offender when it comes to our gross inefficiency of energy used, and in the area of air pollution. Air pollution makes us turn around and use more energy to keep air out. In its planning role, the design professions can have an effect on decreasing the dependence on private automobiles. It will not have very great effect, however, unless we work toward it as a constant objective.

MR. HOWE: Just before the subject gets too cool, I would like to speak as an owner for just a moment. It is very interesting to me that the representatives around the table come up with the same old problem, the chicken and the egg and who is responsible. And I have come to feel very strongly that it's the owner that has to be the guy to put his finger in this loop and stop the chicken and egg debate. It is a matter of who is the best one to initiate whatever action has to be taken. My thinking is that the energy crisis is going to be the motivating factor resolving this segmentation in our industry.

The point I would like to make is that the owner is the guy we have to look at to start the thinking off because he is really the motivator there to get the right kind of a job. The second group we have to look at are the architects and the engineers, because they are the next step after the concept of what

Hines

the owner wants to accomplish.

The important thing for the owner, as somebody mentioned, is that we don't ask the architect and the engineer to produce a building in a given way, but set forth criteria, letting the architect, engineer, producers and everyone else pick up the ball from that point.

It is terribly important for the architect to take a very strong position in not going ahead, even to the point of not going ahead with the job and dropping the client.

Another important responsibility is to give the architects the tools. For years we have been demanding the critical path method of our contractor to make sure everybody stays on schedule. Now, as in the Post Office job we did with IBM, we have adopted a program to evaluate alternatives that are available to us in the design of a building. We have designed four buildings with this program and, on a duplicate basis, measured it against what the architect came up with, and have found that in two out of the three cases, as a matter of fact, that we have been able to vastly improve the alternative that we select.

So the question comes up about who pays for the experimentation. And here again the owner is going to have to assume the responsibility, his portion of the responsibility for that. His confidence is going to be enhanced by a very close working relationship, particularly in the beginning of any project with the architect.

If there is any communication to be done by government or by anybody, it ought to be done with the owner.

MR. HINES: I would like to second that and say that it is a responsibility. We talked about leadership. It is the responsibility of these continuing owners who are again getting a little bit greater segment of the market to develop, as we have done, in-house design and engineering capabilities to evaluate and coordinate, acting as a recipient of and resource for all of our building managers.

These buildings, as designed, can be $10 to $12 a square foot versus $3. Having this in-house skill in your operations department acts, as we call it, in conceptual construction, and does the research that informs and supports the architect and engineer in setting standards. We set not only a new factor in our operation. We set an operating cost per square foot. So we're trying to operate our buildings for 30 cents a square foot. That's a very low utility cost in the building industry.

But only look at the incremental parts, adding them up, and we still don't get the lenders and the credits of that in the capitalization factors which, in turn, allow us to look at that better building in terms of giving us a few more dollars in top rate.

They set the same top rate whether it's you or anyone else. The life insurance industry is probably the greatest producer of goods in this area by insisting on a life cycle look at operating costs, getting into it a little deeper, and giving a different top rate because of the increasing products that that person is producing. Certainly, they have a greater impetus for creating better products in this country than any other source. Every builder, whether he is a continuing builder like this group here or the one-time or the three-year owner, has to listen to him.

Let's say you put it in terms of New York where the situation of the floor-to-area ratio is related to, for example, a plaza. Relating this to the structure, you are undertaking a kind of leadership by example, and that leadership attitude around you, in other structures. So the two parties, the owners and financial institutions, are together.

It is true that one has to take on the burden of additional overhead in providing leadership to the architects and engineers, and be willing to be knowledgeable, open to new concepts. That kind of response takes an ongoing program; it takes a good million dollars of overhead. We spent two and a half million dollars of overhead. That's the problem. You have to have more of those people in the business so that, as a matter of course, the knowledge, and the costs, can be shared.

MR. DALY: Of course, you fellows represent very sophisticated owners. You have to bear in mind that maybe 90 percent of the owners in the United States don't have at hand the common knowledge and technology you would have. So when you talk about owners, you have a big educational problem ahead of you if you are going to get them up into the sphere you are talking about.

These are tough problems. Maybe it is the responsibility of the sophisticated owners and operators of properties to set some standards which the design professions can be responsible to.

MR. HOWE: I say it's the responsibility on the part of the engineer to do a selling job, to do the job right. We look to architects and engineers in the same way.

MR. DALY: I guess our problem is we don't know what is right. The thing we're saying is let's go into an intensive period of study so that we find out what the right standards are.

MR. HINES: The problem is you will never get the feedback; the owner will never reveal his costs. I think Ford Motor Company isn't going to give out 100 percent of their proprietary methods of manufacturing, nor will you get a builder that has developed certain techniques. I am just being very practical—they are not going to give 100 percent of their techniques so the man across the street can compete with him tomorrow and lay it out so that if he has gotten an advantage of 20 percent in operations and comfort or cost, he is competitive. I think that you have to show he's not that altruistic.

MR. PECK: Let me make some points relative to this. The fundamental question of research, I think, is the wrong statement. I think the industry knows all of these things when it gets down to communications.

The perception has come to us, at least in pursuing one of Mr. Meisen's programs, that once you get a team to sit down and work together to optimize a system—that's an overused word, but this is what we are really talking about, to *minimize* energy—it is relatively inexpensive to rejigger it for other parallel-like buildings.

What will happen, as we build a few buildings that are energy-optimized, is that various people who have something to gain from this thing will present it to the potential owners, whether it be the little one or IBM.

What we should emphasize, at this point, is getting some tools that the industry can use. One important tool that was mentioned is a computer. There are a number of computer programs available but most of them have been designed for optimizing equipment selection —for instance, to tell how much insulation you ought to use.

We need a computer-based program which can deal with whole systems, not just parts, and we need to get industry concurrence and leadership towards a program which will be available, usable to all. I think that is an important tool. Not that we won't end up needing regulation, but to the extent that we can get an independent information system going for industry, making tradeoffs, rather than somebody writing a a piece of legislation in Washington every five years, we'd be a hell of a lot better off.

MR. STEWART: I don't want to appear to be speaking in defense of the lending industry. I do appear to be the only lender here, however.

Some of the things that have been said are absolutely right. In the capitalization process of appraising a piece of real estate, there is no standard for energy efficiency. And there ought to be. I think our problem is that I don't know where to go to find standards of energy efficiency. It isn't written down any place.

We tend to back a developer who has a record of being efficient and ending up with a good product. But there is not a scientific way of doing this sort of underwriting.

MR. MEISEN: I was going to say that Arthur Sampson, Administrator of the GSA, has that as one of his primary goals, the development of reasonable yardsticks against which you can measure the relative efficiency as far as energy conservation. We would hope, in a reasonably short time, that out of what we have learned from our project in Manchester, New Hampshire, maybe we will be able to give you just that kind of a tool.

I think I would like to just expound a little more on what Leo Daly mentioned—that you have four rather progressive, responsible owners here. I think it is a little unfortunate, although I don't know what you can do about it, that in bringing together meetings of this type with such owners, you become lulled into thinking that *this* is the industry. And it's not the case. Similarly, I look here and see probably four of the most progressive architects in the United States. I would love to say that they are representative, but I am quite confident that they are not the average architect. It sort of brings me around to what architectural forms can do. I have a feeling that, as a whole, the design professions are probably some of the most conservative people in the world. They would rather incur the wrath of a client than of another professional.

What you publish in The FORUM probably means more to them than anything we could say at a Round Table. When you show a building that wastes energy, holding it up as an award-winner, that's what other architects and engineers are going to design.

They are very sensitive to criticism from their peers. You are very much their peers when it comes to publishing what is good design. And I think it is critically important that you, as a magazine, take a policy stand in view of the pragmatic interests of the country, to support as design *challenge* and, as a basis for deciding design merit, the conservation of energy, as well as those aspects which may not make the most beautiful pictures, but are yet basic to coming up with the best building.

They will much less tolerate professional criticisms than they will outsiders talking. The owner or producer can say something; the public at large can say something, but if you really want to say something, have another architect say it.

MS. GUEFT: I think you are quite right. One of the interesting things about the energy crisis is that it happened so quickly. Really, five years ago, you wouldn't have cared whether the building was practical from an energy standpoint.

MR. DALY: You know, if you look at building terminology, that utilized during design, you find it is composed mostly of the standard jargon used by the various professions involved.

A knowledgeable owner like you fellows might say to an architect - engineer or a planner: "In this room we want 150 candle power." Still, most owners just say, "We want a room so big to hold a meeting of 20 people maximum." So the electrical engineer who is laying out this room goes to the National Electric Code and picks out the light level fixed ten years ago when Con Edison or somebody was pushing energy down our throats and you were unpatriotic if you didn't use it. But he goes to that standard and he picks that figure off. It might be 100 foot-candle power; it might be 125 foot-candle power. If you get down to the mechanics that you have to tackle if we are going to change peoples' attitudes and customs—those responsible for owning, directing, designing buildings—then you have to get those little books that they use when they go to set a standard.

MR. MEISEN: I think the owner has to make a decision. I think if you just think about what went into it, you will see the average office building has one or two fixtures every 25 feet.

If anyone had been a little scientific, he would have found that in a 100,000-square-foot office building there are 4,000 lighting fixtures. If he would look a little further, he would see that there are less than a 1,000 people in that building and it doesn't take a lot of mental gymnastics to see that you have four lighting fixtures per person.

If someone would say that we need that to get adequate light on this guy's desk, they would have said, "Oh, you're ridiculous. I wouldn't think of having four light fixtures over every desk."

I can just see how it first started. Someone went to an owner and said a good lighting level is seventy to eighty foot-candles. Where are you going to put your desk? And the owner said, "I don't know if I am going to rent the space out. They may want to go anywhere."

The owner said, "I'm putting lighting fixtures all over. That's good flexibility." That is what we did.

Now we have these lights all over the ceiling. If someone had said, "Well, gee, it's going to cost $100,000 to do that in a 100,000-square-foot office building, and $10,000 a year in energy, counting air conditioning costs," the owner might have said one of two things. He might have said, "I am going to fix the damn desk. It is not worth it to me because you're not buying the light; you're buying flexibility."

He might have said to the engineer, "Well, gee, can't you get a fixture that I can move?"

Half the time, if we just use any kind of a cost analysis technique and go to the owner and say, "Here are your options," the owner is going to make the right decision nine times out of ten. I think we have to get away from that a little more. We have to nail down what the options are.

MR. SWINBURNE: Wally, you just left out the last step and said that when we moved the desk, the lights went with it.

MR. MEISEN: It's a possibility.

MR. CLARK: May I respond to this? First of all, in addition to what Wally said, we have to remember that our past history was predicated on a reducing energy cost and an increasing efficiency of light source.

It is estimated that about five percent of the total energy in the United States is used in lighting. The Bureau of Engineering, a year and a half ago, made some concrete proposals as to how we might save some energy relative to lighting.

I don't think that the lighting standards can be above criticism but they have to be knowledgeable and constructive. I want to emphasize "knowledgeable" because most of us who have been a little bit on the firing line on this situation for a while repeatedly find that people don't understand the recommendations. They just absolutely don't. Practice has ignored them. And yet, when the defense comes up, it goes back to the recommended practices. I think we are talking of consistently higher levels and have recommended, in many cases, the definition of lighting levels on *a* task, wherever it occurred at any time. This is overlooked.

I think we have to champion the cause of eliminating waste. It was interesting to me, some months ago, to look up the definition of conservation. There were some arguments here as to whether this was truly descriptive of what we want to do. It was kind of interesting that one of the items was "elimination of waste." It also referred to human energy conservation, and energy also. In addition, we must be concerned about the interests of those using light, and about the quality of light in our designed spaces, both of which were alluded to earlier.

So we are at the unnecessary junction of what light brings to people in terms of general well-being. We have to look at this balance. A lot can be done before we start modifying life style. You also have to remember that lighting is an energy saver as well as an energy user. I'm not talking just human energy, which is part of it, but we can't look at a building as a black box all in itself.

The question is, if you dis-

Daly

turb the quantity and quality of lighting, how much do you reduce productivity in terms of the number of products per man, the number of defective products per man, the number of men required in that place, the transportation to get them there and home.

Another factor that has to be considered is a better discrimination among the various elements in the design process which contribute to the final lighting design. Too often they just get locked into one hole. There are a lot of different influences along the way, among them a better understanding of recommended practice for realistic understanding, and a new level of professionalism among those designing installations.

We have a serious problem in the lighting field. Perhaps not more than 35 or 40 of us in the United States are graduate illuminating engineers involved in lighting. A great many other classmates have gone into other fields. That starts the day you step out of college as an illumination engineer. Most of what happens along the way is a long-term process of learning, and I am proud to say a great deal of this is due to the Illuminating Engineering Society. What they have discovered has been a part of the education of those who are not immediately involved.

One other point was brought out in relation to this. We need to better design lighting goals. We are repeatedly handicapped by not having adequate knowledge the day the lighting decisions have to be made as to what the other elements are in the building.

MR. MARLIN: I also think it suggests a starting point for discussing other areas of lighting products.

Let's sweep the slate clean. Let's pretend that there was no glass. It is my understanding that the builder in the street is doing a good deal of reevaluation and is looking at the state of the architect as he is and trying to find pressure points where improvements can be pushed.

I know, in the field of aluminum, that this is the case. I know that Alcoa, for instance has been concerned about the by-products of its products. Would Mr. Mader speak to this?

MR. MADER: The supplier has two areas he can assist us in. One is completely out of size, the effect and relationship of the building industry, that is, what we do about our basic processes and their energy consumption. Now we have more of an opportunity to do something with impact, simply because we are working on the biggest chunk of energy that we effect. Industrial use today is about a 40 percent factor in total energy being used in the country today.

For a while we were being shellacked in some areas because what we do, and what we are planning to do, is misunderstood.

Barry Commoner, the environmental scientist, pointed out that aluminum uses six times as much energy to produce as steel which, on the surface, is a reasonable statement if you are talking about per pound of steel versus per pound of aluminum. What he missed was that aluminum, due to its specific weight, will go about three times as far per pound, which Barry Commoner now admits puts it down to a two-to-one ratio, rather than six-to-one.

We have had to go through the educational process of saying that no one uses as much steel ingot or aluminum ingot as such. That the real way to indicate the energy use is at the end product level. Without going into a lot of detail, I can tell you that if you were comparing aluminum and steel at the end product level, you would be somewhere at a ratio of around 1.2 to 1.4.

But these are two different materials with two different sets of properties and uses. They are pretty much in the same area so far as basic requirements to produce them.

But we can still do more in the area of industrial reduction of energy than the impact we can have on energy use in buildings. Let me give you an example. In 1940, the energy consumption of aluminum per pound was 12 kilowatt hours. Today, the average in the industry is down to about eight, and the better, most recent facilities operate at about six and a half. We have just announced a new process, which we are backing up with a major plant in Texas, that will reduce it from this to four and a half —another one-third reduction.

Now, we wouldn't claim we are doing this out of just a sense of public responsibility. We were working on these processes 15 years and $25 million ago. But we know that the energy shortage will continue, and that the best way in the world that we can help ourselves, from a cost benefit basis, is to reduce our consumption of energy. Now, that is the industry side of it. When we come over into the building industry part of it, I think that what we are trying to labor under are some early, pretty broad and publicized statements which are really more mythical than practical.

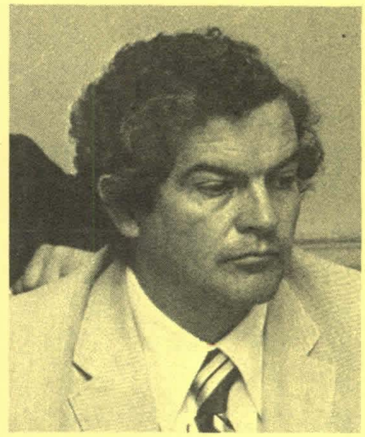
I think the first of those that got wide promulgation was the fact that the energy shortage really is going to last until 1985. This leads too many people to say it's only a contemporary problem. Other people talk about the coming of the laser fusion reactor. This is going to make things all well because there won't be an energy shortage. The truth of the matter is that even if we get out of an energy shortage, the cost of energy is going to go up. So we do need pressure for energy conservation.

The second thing that has been discussed here is, since we have an energy shortage, we need a broad, new, effective technological innovation to reduce consumption.

If I got Herb Swinburne's point—frankly, Herb is usually a clear voice out of the forest —I think he was saying that it is not new technologies we need but to do our thinking more appropriately, get rid of our hangups, our conflicts of interest, and use the technology that we have more effectively so that energy becomes marketable to the developers, to the owners, to the financiers. Thoughtful use of technology is a place where we can do a lot. We can do qualitative analysis of situations.

We can do ideal work and product development. Most of all, we can help educate you with what we have learned by our enterprise.

MR. SWINBURNE: You said innovative design, not innovative technology.


Becket

MR. BECKET: I agree that it is going to take all these forces put in on a very short basis. Going back ten years ago, when energy was cheap, why can't it be cheap ten years hence? Certainly we want to conserve. But there is absolutely no reason, *absolutely* none, that our innovative designs of the energy producers cannot produce a design that will be relatively cheap in the future. I disagree entirely that energy has to be more expensive in years to come. I think it can be cheaper.

MR. MADER: I was thinking of restrictions which have kept the course of energy low, about governmental regulations.

MR. SHEPHERD: I don't know about the facts, but I'll be glad to give an opinion. I think there is no question that energy costs are going to go up for the rest of this decade. I personally think that they could come back down and we could again have a situation where the United States could be totally self-sufficient in energy by the 1990's. Nobody really knows this because there is a multitude of factors bearing on it. In that period of time that energy could be as cheap as it was, say, in the 1960's, it will be energy developed from different bases. It will have to come, in that case, from nuclear power, from the use of coal in a more sophisticated form, perhaps from solar sources, and perhaps from some techniques that we haven't thought of yet.

I rather agree with Mr. Becket. As this becomes a major problem in the United States and people—not only engineers and technicians but — those with real scientific genius and inventiveness—start applying their minds to this problem, the energy situation of the latter half of the 1980's might be quite different than the latter of the 1970's, and one which no one is correctly forecasting.

I think it is worth paying considerable attention to what sort of energy mix we are going to have five years from now, or in the 1980's. I can't give you an answer on that, but I can say a word or two about some factors bearing on it and what some people have thought.

Most of you are familiar with the National Petroleum Council study, "The Energy Outlook for the United States," which was done at the request of the Secretary of the Interior—a cost study of energy supply and demand through 1985. In that year, they used four cases. Case Four was predicated on the fact that there would be basically no change in U.S. Government policy and no significant advances in technology with respect to finding and developing oil and gas. Case One postulated that there would be a major change in U.S. Government policy designed to stimulate domestic development of oil and gas and that there would be, in addition, sufficient technical development with respect to this. Then, of course, there were two cases in between.

Using their figures they projected that the United States, in 1985, would be importing something less than four million barrels of oil a day. We are now importing six million barrels of oil a day. So they are projecting that we would be importing less at that time than we are now.

Their Case One projects us importing between 19 and 20 million barrels of oil per day. I bring this up because this very knowledgeable group of people argued, essentially, that U.S. Government policy could make that much of a difference in oil and gas production, which is what makes the difference with respect to those importing figures.

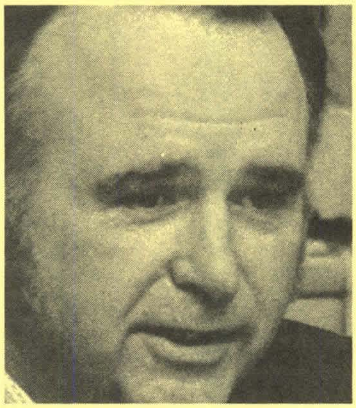
Now the very interesting thing about that particular set of projections is that they held the percentage of use of coal relatively steady.

I think it reasonable to postulate that if the U.S. Government policy can make that much difference in the amount of oil and gas it has developed in the United States, it could also make a tremendous impact in the amount of coal that is developed and used.

So we may find ourselves in 1985 with the energy pattern predicted by the National Petroleum Council, but probably we won't. We will find ourselves in some other energy pattern.

I think that there will be a decision to place a very high priority on development of domestic U.S. resources, partly for national security reasons and partly for balance of trade.

You probably have all seen



Shepherd

some sort of projections or discussion about the impact of importing vast quantities of oil on our international trade or balance of payments situation.

The President's energy message or, rather, his background statement to it, estimated, regardless of what is done in this country, that we will probably be importing ten to twelve million barrels of oil per day in 1980. If you assume that, and the cost is $5, and this is probably low on both counts, that's $50 million a day, which is going to run into the order of $20 billion a year. That, in and of itself, is considerable incentive to develop a domestic energy program, realizing that it is going to cost more, a *lot* more for the period between now and 1985, let's say.

I don't want to pick that as a magic number, but somewhere in that area. I don't think, with all the technology in the world, that we can meet the objectives of the environmental program which call not only for having fuel which can be burned in an environmentally acceptable manner but also for producing it in an environmentally acceptable manner. When we get to coal, those are very serious problems. So it will cost quite a lot more money.

As we move toward domestic energy sources, I would like to mention that we will run into a conflict on the way the energy should be used. On the short term, it's probably futile to stress the energy of electricity, because in Btu's consumed, it takes a lot more to deliver to the user than it does natural gas or perhaps fuel oil.

For those of you who haven't followed it, there were four days of hearings in Washington on the voluntary petroleum allocation program, one which was instituted mid-May so that oil, petroleum and petroleum products might be more equitably distributed to the system. Most of the testimony urged that the program be mandatory.

The Senate has passed a bill by Senator Jackson, calling for a mandatory petroleum allocation program. That's a very difficult thing to administer, but it could have quite an impact on the end-use availability of fuel.

The Federal Power Commission has already set curtailment priorities for the use of natural gas. What I'm suggesting is that you keep in mind (looking now when you're building the building), is the question of what kind of fuel will you be able to get and what steps can you take to assure that you will have a continuous supply.

If you're working in fuel oil as distinct from natural gas or electricity, you may want to design a considerably larger storage facility than you would have otherwise. If you're working in natural gas, or perhaps even electricity, you may want to take into account what sort of alternative fuel source you could use in case your fuel is shut off. Because if we do go to a ten-day blackout the resources to remedy that very quickly won't be at hand. Another one might follow within a very short time.

While I've got the floor, let me say one more thing. In terms of what the government can do in energy conservation, I really think that you will see a very much heightened effort in this arena. It will start out, I am sure, in terms of voluntary measures, emphasizing what the government can do to create a climate which will make energy conservation not only a legitimate thing, but a very desirable thing.

We need to develop an energy conservation ethic. I think the Federal Government will lead the way, partly through the sort of thing GSA is doing, to show what government can do with existing buildings as well as new ones, what government can do in the way of energy conservation practices, in other areas, such as perhaps purchasing smaller cars, adjusting heat and light to usage. What kind of car do you have, Walt?

MR. MEISEN: A Pinto.

MR. SHEPHERD: That's a new change from the black Cadillac.

MR. MEISEN: We are trying to get developed a six-passenger, four-cylinder.

MR. SHEPHERD: Which is not made in the United States today?

MR. MEISEN: That's right, which we can't buy domestically, which is a problem for us. But I think it's on its way.

MR. SHEPHERD: I would urge that if we talk more about the role of what the government could be, that we talk about government regulations. I've been involved in a regulatory program for three years now, and it's a tough sort of thing to administer from Washington.

MR. BECKET: I have got a very good suggestion. Why don't you just offer 20 or 30 million dollars as a prize for someone to invent something as a new source of energy, and let's get on with it?

I don't like your date of 1985. I think that the American people and industry are much more innovative, and work much faster than that. I really do. I just think there is a source of cheaper energy. We have been talking here about stop-gap measures.

Mr. Deimer mentioned that architects don't have enough money to do research. We do and are doing it. You mentioned water. We just finished and are coming out this fall with something that will reduce usage of water by a total of one-third. Why don't they do something?

MR. SHANNAHAN: I think from

a lot of discussion around here that probably most of us don't recognize how completely we have gone into a revolution as far as basic energy thinking in Federal policy is concerned. I see nothing ahead but increased costs, and for some very good reasons.

If you go back to the 1930's, the time that TVA was built, and some of the other Federal projects, we were really in a Federal policy of the most energy available at the least possible cost. Some of the costs were either not recognized at that time or were deliberately not passed on to the consumer. We developed Federal and state regulatory levels with the sole objective of keeping the energy cost down. We have recognized that there are energy costs which have not been reckoned with, such as environment, such as long range research and development, and these are entirely new fields of cost which the consumer has not been asked to carry on. But he will be asked.

You realize that today if we started a nuclear power plant any place in this country, it would be ten years before that plant would be available to distribute any electric energy. It takes that long to bring a plant into service because of the construction, the regulatory and the administrative delays. So what we are dealing with, in part, is a shortage of lead time. We simply cannot move rapidly enough to make additional energy available.

Your basic energy problem, as far as the electrical side, is going to be in two years. It is going to be a shortage of capacity because of this long lead time, and it is also going to be a question in some areas of fuel availability.

The electricity has been basically coal-based, and coal is almost unavailable today because of the environmental requirements. We simply do not have the technology to remove sulphur from coal, permitting it to be burned in power plants and meeting the environmental standards.

Could this be done, we would have no energy problems in this country for a considerable time. Nuclear power is extremely costly from a capital standpoint. A nuclear plant today is in the neighborhood of $300-500 per kilowatt. We used to be able to build coal plants and gas plants for between $85-100 per kilowatt.

Now all of these additional costs in view—those in environmental considerations, those in research and development—are going to have to be passed on, in one form or another, to the consumer.

Some people in the industry are predicting about a five percent increase in energy costs per year, particularly if the present rate of inflation does not change.

So one of the major factors that is going to be influencing building design, building usage and building construction is this matter of energy costs for operation.

There is another area that has been touched upon briefly, and that is the relationship of transportation or the building design. And this gets into the whole area of land use.

We are basically a people based on the individual automobile. As our planning, design and building concepts get away from that, we will begin to have some major solutions for transportation.

Another thought on transportation and energy and natural resources. There is a lot of work being done today in coal gasification. Strictly from the standpoint of substituting for natural gas, there is perhaps another and maybe better use for the result of coal gasification, and that is for the transportation industry to use this product as a substitute for gasoline in the automobile. To do this would not involve any changes in automotive technology. The present engines, carburetion and so forth, can be readily designed to take this new product.

But I don't see, from what we know today, how we can reasonably expect anything in the way of reduction in energy cost in the foreseeable future.

MR. BECKET: Why does it take ten years to build a plant?

MR. SHANNAHAN: A great deal of that is in red tape. General Electric Company, for example, has made a statement, and this actually happened. They contracted to build two nuclear plants, one in the U.S. and one in Japan—practically the same plant. The Japanese plant is in operation; it took four years. The other plant is at least four years from operation simply because of two procedures.

MR. BECKET: Government procedures?

MR. SHANNAHAN: Yes.

MR. DALY: Environmental impact statement?

MR. SHANNAHAN: Both. Largely it's environmental. You realize that under the environmental laws, any person, for any reason without qualification, can delay the court procedures on any project almost indefinitely.

MR. BECKET: I must say that I was trying to get you to come out with that because, frankly, at the risk of being very unpopular, I think the environmentalists have gone too far. I think it's ridiculous what they are doing. If we can build a plant here and you people can't get it down to four years, then we are going to be in 1985. I don't think we should be.

MR. MARLIN: At the risk of sounding Orwellian, I would like to stop at 1984 for lunch.

AFTERNOON SESSION

MR. MARLIN: What can we realistically do? What kind of mechanism for research and dissemination of information can be created? Who should be stewarding this?

Long

A point was made that there is no one sector of the industry represented here that could pretend to be the sole leader in creating this kind of mechanism but, given that, how do we go about creating a clearing house? We have not yet heard from the representatives of the steel and glass industries. I would like to get some recapitulation, some impressions from their spokesmen, who have not really had an opportunity to say much.

MR. LONG: We have been talking around the central issue here, which is this: The energy crisis is just one more manifestation of the glaring imperfection in our entire economic system. For as long as economists have written about it, the social or consumptive cost in products is not accounted for in our economic system, the capitalistic system. And I don't think today that we will ever be able to factor those costs into day to day buying decisions, owners or what have you.

We have an imperfect system. We have to talk about working within that system because it is not about to be changed today. There will be, as has been made clear, legislative action toward a broader view of the energy crisis.

The question is how can we, in our own way, change the demand for our products and services in order to make the most of the energy crisis? That is perhaps a little pragmatic. But I really think that will be the way we take action.

My guess would be that Leo Daly will go home with an increased awareness, although he has been in the forefront in this area, of the profit opportunities in terms of the energy crisis. He will develop and promulgate—I think that's an important part of it—the special expertise for service on the part of some of us, special products which will help in terms of the energy crisis.

For example, Mr. Howe says, "I want to build a building which conserves electricity, conserves heating fuel and what have you, to the greatest extent possible within the bounds of being competitive in terms of first cost. Give me a study in three or four weeks that generally roughs out the specifications for that building, so that we can go to the board and get authorization to build it." He probably couldn't get a very good answer from any of us.

In my view, what we really have to do is to go back to the basics of marketing. We have got to first tell our story better. We obviously have demand today on the part of even the least sophisticated owner for a better building in terms of energy consumption.

I can't imagine that anyone is unaware that steel costs are going to go up in the next ten years. Even the first home buyer. And the responsibilities in terms of knowledge and products and services is going to make profound changes in the construction business. We are going to capitalize on that underlying demand if we are ready. So it isn't a question of who has to take the lead in terms of change in the consumer's attitude. It has changed today, and it will be taxed to come up with the technology to meet the demands.

We have got a lot of diverse products available in our bag. But I am not sure we know how to tell our stories sufficiently to the diverse interests involved in building decisions in order to respond effectively.

MR. DALY: Who are those interests?

MR. LONG: Certainly the architect is the top influence because unless he is informing the owner of the possible tradeoffs, they will never take place. If I tell my story to the architect properly, improving his bag of tricks if you will, then he can tell the owner the story.

MR. DALY: Doesn't that bag of tricks have a bad connotation right now? We ought to strike that from the record.

MR. LONG: We've had a profound change which would have been inconceivable ten years ago with the advance of the construction manager or the construction management team. The basic demand for that service was that construction costs went out of sight very rapidly. And very few people stepped in, told their story properly and, as a result, a demand for their services is right off the top of the map. And we all know who those people are today.

They put together bits of information from throughout the industry in a package and they consult their services almost at will today. We are going to see the same thing resulting from this energy crisis.

MR. MEISEN: The problem is recognizing that there is a decision to be made. By lack of decision, or by lack of knowledge that one is even required, we make decisions that are not working towards our best interests overall.

Almost identifying those choices, as you have said a number of times, is the real key to it.

MR. LINDQUIST: I am a little confused because I don't know the owner who is given the decision to make, whether his energy cost would be high or low.

MR. MEISEN: You never got that decision to make.

MR. LINDQUIST: And he might quarrel about it. He might squawk about the design.

MR. MEISEN: But at the right point in time you never got that choice to make. That's where we have to start.

MR. SWINBURNE: Efficiency costs money in terms of initial construction cost.

MR. HEERY: If the performance criterion is the same, and if you are talking about the mechanical and electrical systems.

MR. SWINBURNE: Innovative design, understanding these kinds of efficiencies, will give you long term life cycle cost. This is a design factor and I am sure this is what you have worked out.

MR. DALY: The right thing ordinarily will not cost you more money.

MR. LINDQUIST: That's not my point.

MR. SWINBURNE: It won't cost you more money in the long term effort.

MR. LINDQUIST: Unless you go into something shoddy and cheap.

MR. DALY: Even the initial cost won't necessarily cost you more money.

MR. SWINBURNE: Let's put it this way. I need 1500 tons of air conditioning. The cost of the efficiency package is going to be more initially than the long term. It's cheaper for you to buy that initially higher costing package.

MR. DALY: What we are saying is that 1500 tons is just one part of it; the architect might turn the direction of the building, or shade its glass, or put additional insulation in. You can pick up one of those brochures of Con Edison. You don't have to have these big meetings. So if you plan in conjunction with nature it shouldn't cost you any more to do it right than it does to do it the way we've been doing it.

For the last 50 years in the United States, the use of energy per capita has doubled every ten years. With the occupied space in the United States having remained constant over a 50-year period, you don't have to be too smart to know that if that continues, there is no way that we can keep up.

MR. GLIDDEN: One of our biggest problems is where do we spend our money in research and development to get some return? Our problem is that we really have a hard time measuring what the customer wants.

One of the very high horsepower operations you have in this country is the industry's desire to sell a product at a profit. If they know what the target is, they can go after it. But if you leave it up to the industry, we are going to be very imperfect in defining the targets. You have to look to the people who are making the judgments to determine where the money is going to be spent to find those targets so that industry can reflect this in their solutions.

Glidden

If you are looking for industrial development, new products, that will help in this area, I think the architect and the owner—basically the owner, the guy with the money—is the one who has to target us so we know where we are going.

The second thought I have relates to the governmental comments. Some four or five years ago, the environmental problem was before us. And at that time the government established certain standards. The building industry is about to get caught in the same pinch that the industrial sector is caught in. That is, standards were established and they were the best standards at that point in time. But since then our knowledge has increased significantly. So that, in my view, the standards that were enacted as part of the EPA operation should be reviewed and evaluated. I think that might lend some large margin of latitude as to how we can solve this problem in generating energy, so that hopefully we can solve it before 1985.

MR. ALTER: Going all the way back to what Mr. Stewart said before, he mentioned that it would be easy to invent the job if they had some yardsticks. I wonder if there is some way your publication could get it all together by striving to arrive at some yardstick for various types of buildings, functions to provide and, you know, develop it into a Good Housekeeping "stamp of approval."

There are buildings that are good, like there are cars that are good. The Pinto does 36 miles to the gallon while others do only 11 miles to a gallon. Somewhere along the way and because we are a society that likes to have cars easily seen, I think that you could use something to label it as a good building or a bad building.

MR. LINDQUIST: This gets very complicated. You find difficulty comparing. Again, you have a decision as to whether a garage is desirable. At one time it was mandatory to have so many units, parking units per building population. Now there is a trend the other way, that you must not put too much garage space in a central area because it increases vehicular traffic where it doesn't belong. If you are trying to develop some kind of a standard, if you try to define those standards in a way where they do not penalize construction which, though it may be high in indirect energy cost, is also very high in value.

MR. ALTER: While it certainly wouldn't be an absolute kind of a standard, at least it would be some kind of a yardstick before one applies judgment.

MR. LINDQUIST: It's a good concept but it is difficult to apply, as is everything worth doing. But it is difficult to not confuse the level of service offered with the cost of operating the service; that is, if you are willing to put twice as many people in an area, your cost of sustaining those people in that area is going to be substantially less.

You can put half as many people in the area. We have market forces and other forces compelling us to provide more space and we have to be careful that we don't let energy *per se* dictate too much of the rest of our design.

MR. SHANNAHAN: Today, under the laws that exist on our books, it is extremely dubious that such projects as TVA, Bonneville and Boulder Dam could be built.

This, I think, is a reflection of some of the basic changes that have come about in our thinking towards the use of energy, the availability of energy and, of course, the cost of energy. In the final analysis, a careful evaluation of the increasing cost of energy is going to be a determining factor in design and utilization. And at the risk of being exceedingly facetious, I would like to offer two solutions to the energy problem, neither of which will be acceptable. The first is to abolish the medical profession and close the hospitals. This would control the population from the average expectancy of about seventy-two years to forty-one years. It would solve our population and our energy use problems.

The other would be to abolish all automobiles except for Volkswagens. I wouldn't object to this. But I think these two, even though they are facetious, even though they are extreme, indicate the degree in which we must face up to some basic changes in our basic philosophy regarding energy and energy use and the total energy cost.

And until we recognize these and are willing to adjust our design parameters with regard to energy costs and related factors, we're not going to find any real answers.

MR. SPENCER: I hadn't thought about doing away with the doctors and hospitals. I would much rather talk about glass. I think glass can defend itself. I believe that man is a creature of nature and wants to live outside. In fact, if you do the worst thing possible to him, you put him in solitary confinement where he can't see. So I believe that he will communicate with the outside through glass and I am convinced that glass will get its share of the business.

I believe that people have not gone to glass in the past over the so-called black box for any other reason than it was the cheapest thing to fill that hole. It so happens in buying the cheapest thing they got a lot of problems along with it. There are many glass solutions to glass's basic problem. Obviously the sun is the best supplier of light and heat, and glass is great in transmitting those. Glass can be adjusted to exclude those in many ways. So I am not afraid of what glass can do for itself.

Basically, I am in favor of energy conservation, and I marvel at the way Europeans are so basically thrifty in behalf of the Btu. Once they decide that they are going to use the Btu in the first place, they certainly squeeze it to death. We don't seem to do that. The American way has been to dissipate as much as possible.

I personally take a dim view of preserving energy on a patriotic basis. I just can't imagine my saving energy to do something for you. You've got to put it in my pocket before I feel it. As a result, if I save energy, and that's good, I am glad someone can benefit. But if I have to do this at my own expense, I am not going to wave a great big flag, and I don't think there are very many Americans who would.

Somehow, you have got to get Jim Stewart to tell you here that if you are going to build a building that is going to use a lot of energy, he is going to charge you nine percent and if you are going to build a tight one, he is going to charge you eight and one half.

Another pressure point is in the energy suppliers themselves. An energy supplier has got to be able to say, "If you build a tight building, I will give you energy and I will give you the right kind of rates, but if you build a loose building, I am not going to give you energy but I am going to give you high rates."

MR. MEISEN: It's the other way around now, isn't it?

MR. BECKET: It is reverse rate they should use. Why don't you do it?

MR. SHANNAHAN: It won't work. Incidentally, the energy rate in Europe is about two to one for this country.

As an example of the interest in this subject in Europe, the North Atlantic Treaty Organization is having a weeklong meeting this October concerning the efficiency of energy use in residential and commercial buildings. This is how intense and worldwide the energy problem has become. I, for one, feel that once the true economics of energy and energy costs get to the market place, a lot of these problems of conservation are going to be solved by strictly pure self-interest in economics.

If we let the true economics come to the surface, then these factors will determine our design, our use, our application of energy. And until these things are allowed free play, we are not going to get a real appreciation of the costs, or of the social, economical and political implications of energy use. And, believe me, these implications are vast.

MR. MEISEN: Are you sure you are talking about artificial governmental controls?

MR. SHANNAHAN: Yes.

MR. MEISEN: I can't disagree with you at all. But I think this artificial control of price as dictated by corporate policy is similar to that which says, "The

Spencer

more you use, the cheaper it gets."

I am not arguing against reduction of government controls. I agree with you. The market place will determine. But similarly, you have to recognize that the market place is not being influenced positively by giving a cheaper rate if you use more energy. It should be just the other way around.

MR. SHANNAHAN: If the economics of the situation are such that the more a particular customer uses, he deserves a cheaper rate, then he should get it.

MR. MEISEN: How can he do that? I would venture to say that if you were short of electricity, you would cut me off as a little user before you cut off the guy that's paying the whole thing.

MR. SHANNAHAN: We are talking about two different things. I am talking about the economics and generation of supply as electric energy. Under certain circumstances it is a fact that a large user deserves a lower rate than a small unit.

MR. HEERY: Because it's less expensive to serve.

MR. SHANNAHAN: There are certain basic costs to serve, regardless of the amount that a customer uses. If, for example, you wanted to reduce electrical costs to the purest simple economic situation, you would have a very high charge to collect and a very low and, in certain cases, almost negligible kilowatt hour cost. It's the initial cost to serve. Now, this whole question of electrical energy. . . .

MR. MEISEN: That is assuming the availability of energy. Once you get to the point where you don't have enough energy, that no longer holds water.

MR. SHANNAHAN: Now, wait a minute. It depends on the cause for nonavailability. If the causes for nonavailability are noneconomic. . . .

MR. MEISEN: You just don't have the energy.

MR. SHANNAHAN: This is something else.

MR. PECK: Then that becomes

Shannahan

another discipline which you are using arbitrarily. Again, look at the economic point of view, the big industrial user. Even though the rate is low, he has a very significant incentive to use electricity or glass, or whatever the heck he's doing, whereas the small user, even though the rate is high, who has to keep his house heated, is going to use it regardless of what you charge.

MR. MEISEN: It is a question of positive incentive.

MR. BECKET: How much can you screw it up?

MR. PECK: Well, you can screw it up pretty badly.

MR. BECKET: If we cut off all of our hospitals and used Volkswagens only, are you home free then?

MR. SHANNAHAN: I am not.

MR. BECKET: Why don't you just produce more energy? I don't understand.

MR. SHANNAHAN: We're trying, but we cannot do it.

MR. BECKET: If I understood you before, you are saying that you got so much red tape from government controls that you can't produce.

MR. SHANNAHAN: Coal, our most abundant natural resource, is almost denied the electric power industry as a boiler fuel because of the sulphur content.

MR. BECKET: What would it take within a piece of machinery to rupture that?

MR. SHANNAHAN: What would it take as a technology to remove sulphur from coal either as it is mined or as it is used? This we do not have.

MR. BECKET: How much do you think it would take? If you offered somebody $10 million, $20 million. . . .

MR. PECK: There are three or four sources.

MR. BECKET: How about incentive?

MR. SHANNAHAN: Millions of dollars is not the question. It's more in the relationship of millions of dollars plus price.

MR. BECKET: I haven't heard many incentive programs come out of this conference and I was just wondering what has happened here.

MR. SHANNAHAN: Most of the available coal in the U.S. of low sulphur content, that which can be burned in relation to the existing environmental regulations, is strip-mined. And once you talk about strip mining, you're in all kinds of trouble.

The coal industry, which is our most abundant natural resource for fuel, is being straitjacketed by regulations. And I am not arguing the validity or the desirability of regulations. I am simply saying that the existing regulations deny the availability of this coal for use.

MR. BECKET: We are denying ourselves energy.

MR. PECK: I do think the point MacDonald has made several times, which is the tradeoff between environmental control and energy, is being made for us at this time in society, and maybe that's not the ultimate tradeoff.

That may be a valid point to raise to all people, including your clientele in California, where everything is stopping.

MR. BECKET: It's ridiculous. I feel a great deal of sympathy for the energy companies that are not allowed to produce energy, as much as I gave you a bad time, because I don't think you are pressuring enough to come out and get these things out on the table.

If you were to offer a $20 million prize and say, "damn it, we want a new way of creating energy," I wouldn't be a bit surprised if you would get it. Maybe it's a public relations job.

MR. SHANNAHAN: I don't believe that the general public appreciates the cost increase it is going to be faced with. I don't believe they appreciate the technological difficulties that we face as a nation in supplying these energy requirements.

MR. BECKET: I want to make it eminently clear that when I said it should not be a greater cost, I said on a pro-rated basis; in other words, I assume that energy is going to be consumed at a much greater rate.

MR. SWINBURNE: You are cheap at $20 million. What I really think we need is another project here with an energy requirement in four years. The question is: How do you move the opinion makers in this country to recognize that there is a crisis?

MR. DALY: You could go a long way toward at least buying us five or ten years in which the generation problems could be tackled.

Let me suggest that the opinion makers, the standard makers of the United States, be brought together in a series of conferences and that studies be made for national energy conservation policy and materials published that would gives us some standard to work for.

MR. MEISEN: Who are the opinion makers?

MR. DALY: In the construction business, they are financial people, owners, architects, engineers, all of the design professions and, more and more every day, the *users* of our buildings.

We of the AIA task force hope to be working with the Bureau of Standards in developing research upon which we can base some recognition on how to conserve energy.

Using present levels of technology, we think we can save considerable energy in buying up time so that the technology involved in the development of power sources and energy sources can catch up.

MR. SMITH: But there are hundreds of architects and engineering firms out there that are paid a set fee on each building based upon however the fees are arranged. And once the fees are arranged, then this engineer or architect has to grind out, in 90 percent of the cases, a design for a building. Generally what he will do is to take a building or a system that he has used in the past where he can cheat or not cheat but copy the existing designs so he doesn't have to spend the design time or the engineering time to change his system.

And I don't know how many cases where we worked on buildings where the engineer or architect would not even listen to our story or some other story.

MR. BECKET: That is an absolute error. There are a lot of architects, I admit. But I do think there is a solution here. I must say that the owner is really responsible. And as much as all of us are talking about aiding him, he is the one benefactor of any project that you want to talk about. Unless that owner says, "Look, it is better for me in the long run," and he can pass that on if he wants to sell in three years or ten years at the end of an appreciation program and he can pass on those same benefits and a good building, it makes all the sense *in the* world to do just that.

MR. HEERY: Speaking as a member of the AIA task force, I would like to tell you what we are doing.

I agree with Mr. Deimer that there is a leadership void existing here. But because there is a void, the American Institute of Architects can at least walk into it.

Architects are admittedly guilty of undertaking projects for which they don't have adequate resources. We recognize the fact that the typical architect and the typical engineer are under such economic pressure that it is not feasible for them to undertake what amounts to a project. What we are undertaking basically is a program in conjunction with the national standards that will have three aspects to it: Technical data publications, a guide for lower operation costs and, hopefully, lower costs in energy conservation for use by practitioners; a series of basic recommendations, continually updated, regarding criteria for all forms of governmental owners and governmental finance sources to utilize as criteria in building standards and designs; third, a series of continuing technical recommendations to building approval agencies. We haven't run headlong into producing these yet.

I would have to disagree, based on what I know thus far, with Don Becket, that we are likely to have a solution inside the next ten years. My personal opinion is closer to 20.

I also disagree with the thought that we should have a general relaxation of environmental control. There is no technology that anybody seems to have for getting the sulphur out of coal. At the same time, putting that coal into the atmosphere would be absolutely and totally unacceptable; in my view, just as unacceptable as a shortage of the energy.

So my feeling is we have got to look at energy conservation knowing that we are at least helping our clients and owners by cutting the operating cost.

Heery

MR. LINDQUIST: I would like to ask a question to see if anybody thinks we will have local governmental jurisdiction, not having a building permit for energy to support the increased requirement.

MR. BECKET: Absolutely. In Florida right now you can't get a permit for anything because of your sewers.

MR. DEIMER: Relying on voluntary manpower or a task force is going to be a slow and ineffective way of coming up with conclusions. I would like to suggest that maybe somehow through a subsidy it could be stepped up, perhaps using the services of GSA in the research that they are doing on this.

MR. MEISEN: We are trying to decide such things, and we can't talk a common language. No one here knows how much energy we are using other than the totals. If I were to say you should use 20 kilowatts or 200 kilowatts for air conditioning in the building, no one would really know that is good or bad.

You know what would change it all? If Bob could say to Arthur, "Hey, I used two watts per square foot in the last building," and he said, "Gee, I used three; I am going to get after my architect." But we don't know whether we are using five or ten or four because we don't even have a common language to know what a square foot is. Yet we are saying we have got to save. For what? We don't even know what our goals are.

MR. HINES: We are going to make sure that GSA is operating economically, too.

MR. BECKET: If GSA would only give more fees to services and not try to scrape up on the engineering fees, we'd be better off setting the standards.

MR. HOWE: When you talk about my comparing notes with another owner, it's physically impossible. I don't know that we will ever be able to do it because of the variables involved—location, cost of labor, materials, weather, there are thousands of factors involved. The important thing is that we develop a means to evaluate alternatives because we know of several different alternatives and there are many combinations.

MR. MEISEN: I think the more you break it down into pieces, just so you know what you're spending for this, this and this, the better you can make a judgment. For the government or anyone else to say you should only spend X for this is ridiculous. But I think it would be real damned nice to know what you are spending for X. I agree there shouldn't be any arbitrary limit on it.

Even at GSA, if we do one percent of the construction in this country, that's a lot. I would like to be able to compare it with what you do and with what everyone else does so that I am less arbitrary if I set up one more myself.

MR. MARLIN: How would any one of you propose to go about it?

MR. BECKET: National energy standards. There are national standards on everything.

MR. DALY: Every building that IBM builds today is built on a certain standard or guideline. And electrical energy is used to set a standard.

MR. HOWE: Every one of those guidelines is applied differently. All these factors. So it is only a guideline; it is not a standard.

MR. DALY: I call it a standard. If people arrive at 20 items in a set of guidelines, how would you make it effectual in the United States today?

MR. HOWE: Well, the twenty guidelines I'd like to see are those guidelines set in a general enough way to identify the things we are trying to prepare in order to optimize at a given location. That is really the point I am making. Find some way to make those guidelines standard but not quantitative.

MR. DALY: Would you make those regulations or laws?

MR. HOWE: No, I am really not going that far. All I am saying is let's identify what we should be looking at to evaluate the efficiency for a building in a given location. That doesn't necessarily mean all you do is apply a cost factor to each of those to come up with an optimum solution or a Btu feature or whatever the situation might be.

MR. MEISEN: But, you know, it is very interesting if you come out and say you are not allowed to spend more than 100 Btu's for a square foot, to use a ridiculous number, within a month there will be 50 people in to tell you why 100 isn't reasonable and it should be 200. All I am saying is, in a week, I'll change it. But all of a sudden everyone will know what you are spending per square foot. And they don't know it now. You shouldn't set the limit but you should know where the square foot is and you should know what you are spending per square foot.

MR. ALTER: Speaking about square footage costs, it seems to us that everybody knows very well how much per square foot office space will cost. There may be variations, but each of the developers and building owners is looking at this building or that building and saying, "These people have built it for $17 per square foot!" And everybody is focusing on that and paying a lot of attention.

MR. KUPFER: But the concept of life cycling cost is only interesting to the sophisticated owner. Unfortunately, there are no unsophisticated owners in this group today. But there are those that will only be interested in initial cost. And if you can by some way or another get the optimum energy use built into low initial cost, they will buy it.

I would like to make one other observation. Mr. Shannahan indicated earlier that total lead time for atomic energy facility is now about ten years. As I recall it, a relatively short time ago it was only half that.

MR. SHANNAHAN: That's right.

MR. KUPFER: And this strain has been largely placed on this particular industry by the environmentalists. I hope that the energy crisis doesn't resolve itself into the same kind of fast reaction to what seems to be a crisis, only to create other crises down the road.

MR. TRISHLER: I represent

Treichler

the other part of the mechanical trades here and, as appropriate, the way it works in the national scheme of things, we get in at the end. Yet between the two of us, George Clark and me, the factors we represent account for 90 percent of the energy consumption of a typical 50-story office building in downtown Manhattan.

And yet, as far as we are concerned, the decisions are made concerning what we provide and how different parts of the building function before we have a chance to do much about it. We are presented with a *fait accompli*, and that's it.

As far as the air conditioning is concerned, we account for about 40 percent of it; everything is decided for us.

Then, to make matters worse, the system of rewards and penalties encourages the cheap first cost approach; and if the building goes over the budget, the first place they look to cut is the HVAC. And the hell with what the energy is, and I am not saying that this was wrong from the standpoint of the owner, the architect or the engineer.

MR. DALY: You know the only thing that hasn't been covered here is the possibility of more sophisticated instrumentation in our present buildings, and in the buildings of the future, that will permit us to do a closer job of keeping the buildings in balance with the environment.

MR. MARLIN: Excuse me, gentlemen. If memory serves, this must be the sixth or the seventh so-called Round Table on energy in the last four or five months. By way of concluding, I am going to ask some advice on where do we go from here, if anywhere.

MR. DALY: If nobody stops us, The AIA, through this task force, is going to come up with some hard facts and research. Based on those facts, the best expertise that we can find and the suggestions that they can generate on an energy program, a set of standards will be produced that can be used by all disciplines.

We need agreement by all the societies that they are going to educate their members, because 85 percent of the architects and engineers in the United States today wouldn't know what we are talking about if we talk of a life cycle study.

And then we are going to try to tackle government, private investment capital — all of the other groups that make up the building team.

Whether anything will come from that depends on how good we are in producing. The motivation lies in the design discipline.

MR. HOWE: The most interesting thing overriding our discussions today is a common goal and interest in conserving energy and, even beyond that, our own orientations, depending upon the environment in which we are operating.

The thought that occurs to me is that we have the opportunity, each of us, pursuing our own selfish interests, or pursuing them together, to come up with this basic motivation, to come up with some of these answers working in partnership. I'd say again, I think the owners have the major part of this. The important thing is to come up with means for evaluating the alternatives. It should come as no surprise to any of you that we are thinking in terms of using computers in order to do this, not only from the design standpoint, which is really in its development stage at the moment, in which we are very encouraged and optimistic, but also from the operational point of view where we have two or three buildings already being operated on that basis with really dramatic savings.

MR. MEISEN: Now I sit at this table, and I think of the real, honest-to-goodness muscle that is represented. I say if we can't do something about it, then who the hell can? The one thing that frustrates me about working in government is that so many people look to the government to do the things for them. And I say all these people really sell themselves short. There is something very positive each one of us here can do if we just appreciate the resources we have at our command and say that what I do as an individual is important because I represent a major segment of corporate policy for my company.

One of the things in government is that people hide in anonymity. Decide you are going to do something positive about it. It might be a little thing, but I doubt it. But decide that something positive to conserve energy is going to come out of this meeting today and that you personally are going to do it.

MR. PECK: I'd like to emphasize that the owner has to do a tougher buying job. They have to demand what they ought to get in terms of energy and everything else they want.

And the architects ought to do a tougher selling job. The big firms will have opportunities in the next six months, with some major clients who might be interested in joint venturing the energy research for some creative, better systems.

Furthermore, the architects could, on a major job, try calling the building producers or the air conditioning manufacturers or people who have some involvement in this area and, before the tradeoffs are made, say, "Hey, let's sit down and see what we can bring to bear against this same team."

The producers ought to think we are going to push commodity products; that's the way we stay alive. We need to think in terms of offering true engineering services in research in these areas to make something happen. I hope we leave it to free enterprise as much as we can to make progress.

MR. SHEPHERD: I, too, hope that free enterprise can do this job or most of it.

At the same time, I should point out that the Federal Government is going to be playing a bigger role in the energy affairs of this country: In the role of domestic production of energy, the import policy and conservation. This means that they are going to have to work out some new mechanisms or new relationships within the government in terms of government programs. We will need to work out some common way in which price and wage stabilization, the development of energy conservation, can all be handled.

Now the government is being called upon or really has to play a role in stimulating the development of new resources in this country. I personally hope that government involvement in the conservation side can be kept to the minimum.

I suspect that if we are going to tackle the domestic production side seriously, we will need something on the order of a Manhattan project.

I have one specific suggestion for this group and that is to aid the process of communication. We are going to develop in the Commerce Department, perhaps in the Office of Energy Conservation in the Department of the Interior as well, either parallel or sequentially, an attempt to serve as a clearing house, to be a point of contact in the government where people can come (a) to find out what government policy is and (b) what its impact might be.

MR. MARLIN: I would like to thank you all for having taken the time for this Forum of The FORUM. While preparing for it I was looking at some essays written in the 19th Century about the history of scientific thought. One author made the point that, until the middle 19th century, science had consisted mostly of a study of one and one equals two, which is to say of *parts*. It has certainly become clear in recent decades that perhaps one and one does not equal two. And the reason is that we have come to learn that we must study the word "and" as thoroughly as we studied the one and one, "and" being the study of organization and coordination. I hope we can go away from this meeting with an understanding of the urgency of studying ways to organize ourselves so that we might come out with a more useful equation for solving our problems, for collaborating in that effort. In that respect, The FORUM will be making every effort, editorially, to inform it.

PHOTOGRAPHS: Page 59 Steve Traiman; others by Tommy Weber.

ENERGY INVENTORY

A selected list of energy research organizations

For those who desire a complete listing of energy research projects, their investigators and sponsors, the 1972 **Inventory of Energy Research** is available. It was prepared by the Oak Ridge National Laboratory for the Task Force on Energy of the Subcommittee on Science, Research and Development of the Committee on Science and Astronautics in the U. S. House of Representatives. The two volumes may be obtained from the Environmental Information System Office, Oak Ridge National Laboratory, Post Office Box X, Oak Ridge, Tennessee 37830. An updated version of the inventory is now being prepared.

Of the 4,375 energy research projects listed in the **Inventory,** The Forum has selected a few that might interest its architects and readers, and has included other projects or research groups suggested by various sources.

SOLAR ENERGY

Environmental Quality Laboratory
California Institute of Technology
Pasadena, California 91109
(Dr. Jerome Weingart)

Solar Energy Laboratory
University of Wisconsin
Engineering Research Building
1500 Johnson Drive
Madison, Wisconsin 53706
(John Duffie)

Solar Energy Department
University of Florida
237 Mechanical Engineering Building
Gainesville, Florida 32601
(Eric Farber)

Optical Science Center
University of Arizona
Tucson, Arizona 85721
(Dr. Aden Meinel)

ENERGY CONVERSION

Institute of Energy Conversion
University of Delaware
Newark, Delaware 19711
(Karl Boer)

Institute of Direct Energy Conversion
Towne School of Civil and Mechanical Engineering at the University of Pennsylvania
Towne Building, University of Pennsylvania
Philadelphia, Pennsylvania 19104
(M. Altman)

Engineering Research Department
Institute of Gas Technology
Technology Center
Illinois Institute of Technology
3224 South State Street
Chicago, Illinois 60616
(Dr. Derek P. Gregory)

Energy Policy Project of the Ford Foundation
1776 Massachusetts Avenue N.W.
Washington, D.C. 20036
(Monte Canfield, Jr.)

GEOTHERMAL ENERGY

Electric Power Research Institute
11661 Vincente Boulevard
Brentwood, California 94513
(Dr. Chauncey Starr)

ENVIRONMENTAL EFFECTS OF ENERGY CONSUMPTION

Center for Advanced Computation
University of Illinois
Urbana, Illinois 61801
(B. Hannon)

ENVIRONMENTAL CONTROL IN ENERGY USE

Environmental Studies Board
National Academy of Sciences
2101 Constitution Avenue
Washington, D.C. 20418
(Richard Carpenter)

Department of Chemical Engineering
City University of New York
245 West 104th Street
New York, New York 10025
(Dr. Arthur Squires)

John Ludwig, Consultant
43 Alston Place
Santa Barbara, California 93108

Paul W. Spaite, Consultant
5755 Glengate Lane
Cincinnati, Ohio 45212

COAL CONVERSION AND CLEANUP

Committees on Pollution Abatement and Control
National Academy of Engineering
and National Academy of Sciences
2101 Constitution Avenue N.W.
Washington, D.C. 20418
(Robert Crozier)

Illinois State Geological Survey
Room 213 Natural Resources Building
Sixth Street and Peabody Drive
Urbana, Illinois 61801
(Jack Simon)

Energy Technology Department
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
(Dr. John P. Henry)

NUCLEAR FISSION AND FUSION

Department of Nuclear Engineering
Room 21-210
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, Massachusetts 02139
(Dr. Manson Benedict, David Rose)

Research Division
United States Atomic Energy Commission
Washington, D.C. 20545

Physicist Controlled Thermonuclear Research Division
Lawrence Livermore Laboratories
Post Office Box 808
Livermore, California 94550
(Dr. John Holdren)

ARCHITECTS INVOLVED IN ENERGY RESEARCH

Richard G. Stein
Richard G. Stein and Associates
588 Fifth Avenue
New York, New York 10036

Leo A. Daly, Chairman
AIA Task Force on Energy
Leo A. Daly Company
8600 Indian Hill Drive
Omaha, Nebraska 68114

John Eberhard
AIA Research Corporation
American Institute of Architects
1735 New York Avenue N.W.
Washington, D.C. 20006

Ralph Knowles
Department of Architecture
University of Southern California
University Park
Los Angeles, California 90007

School of Architecture
Center for Community Design and Research
Rice University
6100 Main Street
Houston, Texas 77001

Harold Hay
School of Architecture and Environmental Design
California State Polytechnic University
San Luis Obispo, California 93401

OTHER INSTITUTES AND FOUNDATIONS

National Center for Energy Management and Power
University of Pennsylvania
Philadelphia, Pennsylvania 19104
(Offers graduate program in Energy, Power Production and Conversion; see above.)

Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

Research Foundation
Ohio State University
1314 Kinnear Road
Columbus, Ohio 43212

United Engineering Trustees, Inc.
345 East 47th Street
New York, New York 10017
(Mr. John Zecca)

GOVERNMENT AGENCIES

United States Department of the Interior
18th and E Streets N.W.
Washington, D.C. 20240
(Stephen A. Wakefield, Office of the Assistant Secretary, Division of Energy and Minerals)

Public Buildings Service
General Services Administration
GSA Headquarters
Washington, D.C. 20405

Office of Energy Programs
United States Department of Commerce
145 Constitution Avenue N.W.
Washington, D.C. 20001

Building Environment Division
Center for Building Technology
National Bureau of Standards
United States Department of Commerce
Washington, D.C. 20234

NASA-Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135

National Science Foundation
1800 G Street N.W.
Washington, D.C. 20006

Research Division
United States Atomic Energy Commission
Washington, D.C. 20545

Environmental Development Division
United States Department of Transportation
800 Independence Avenue S.W.
Washington, D.C. 20590

INDUSTRY

Research and Development
Westinghouse Electric Corporation
Beulah Road
Pittsburgh, Pennsylvania 15235
(Dr. David H. Archer)

Engineering Materials Laboratory
Chrysler Corporation
Post Office Box 1118
Detroit, Michigan 48231
(Charles Heinen)

Research and Development
Southern California Edison Company
2244 Walnut Grove
Rosemead, California 91770
(Dr. Larry Papay)

Dublin-Mindell-Bloome Associates
Consulting Engineers
42 West 39th Street
New York, New York 10018
(Fred Dublin)

Technical Center
Libby-Owens-Ford Company
1701 East Broadway
Toledo, Ohio 43605

Owens-Corning Fiberglas
Fiberglas Tower
Toledo, Ohio 43650
(Bill Fleming)

PPG Industries, Inc.
One Gateway Center
Pittsburgh, Pennsylvania 15222
(R. W. Jones)

Energy Conservation, Conditioning Climate Control Division
The Sewing Center, Singer Company
Rutherford, New Jersey 07070
(J. P. Soule)

BEFORE THE VIRGIN MET THE DYNAMO

Without advanced technology vernacular architecture has combined native wisdom and resources to achieve adequate light and thermal comfort

Henry Adams could see the schism. In his *Education of Henry Adams,* the early 20th century historian aptly chose two compelling iconic images to portray the magnetic but antithetical forces that have unconsciously cleaved the American psyche. One, the Dynamo, represents (in the words of critic Leo Marx) the present-oriented, powerful, utilitarian, scientific; the other, the Virgin, embodies unity, the past, beauty. Thus the schism that the Dynamo and the Virgin describe at a generalized abstract level turns out to be the old conflict between technology and nature. The final reconciliation of one with the other—and their related orientations—we now see lies at the heart of the energy crisis.

It is no secret that America in the 20th century has emphasized the importance of industrialization to the exclusion of other value systems. Yet strangely enough, anti-technological dreams *have* continued to exist as an essential part of the American mentality—as fundamental as the fascination with the machine itself. Mr. Marx describes this tradition of a "pastoral ideal" in *Machine in the Garden,* where he traces the dual but contradictory trends throughout American letters.

Indeed, this "pastoral ideal" has gradually made itself felt in architectural circles in recent years as the disillusionment with the costly achievements of technology have mounted. In the past quarter century, this ideal has been expressed especially by an interest in architecture of the unselfconscious or vernacular tradition. Sibyl Maholy-Nagy (*Native Genius in Anonymous Architecture,* 1957) Bernard Rudofsky (*Architecture Without Architects,* 1964), and Myron Goldfinger (*Villages in the Sun,* 1969), have all documented arresting examples of vernacular and so-called "primitive" architecture. These forms, handed down year after year, display an accumulative wisdom, and an honesty of structure and material expression that can easily escape modern architecture. Writing in a more socio-cultural vein, architects Christopher Alexander and Aldo van Eyck have called attention to the closeness of fit between living patterns and housing typology, or to the unity of house form and metaphysical values of these cultures.

No less important, the fit between design and climate in the unselfconscious tradition has been equally recognized. As early as 1947, James Marston Fitch (*American Building, The Environmental Forces That Shape It*) pointed to the wasteful operations of contemporary buildings in solving environmental stress. Primitive and vernacular architecture, Fitch argued at that time, often attains high performance levels, even in comparison with modern buildings. Ironically, Fitch singled out difficulties inherent in America's faith in technology at a time (late 40's) when the United States was in the throes of its largest building boom ever—when the same glass and steel skyscrapers were looming up over the landscape from New England to California.

The extensive drawbacks in building technology Fitch scored in his book were later described in mordant detail by architect Ernest Schweibert in an unpublished Ph.D dissertation (1965). Focusing on steel and glass construction, Schweibert asserts that thermal movement, glare, heat loss and heat gain illustrate that "such buildings became prisoners of extensive mechanical repair and preventive maintenance, and since their complex equipment systems would not work unless the windows were fixed and sealed, their spaces were uninhabitable, even with a minor equipment failure."

The unbounded optimism about technology and implicit arrogance toward nature can be attributed to a technological determinism that has prejudiced much of 20th century architectural expression: Because technology allows any number of structures in a range of locales, architecture therefore has to respond unilaterally to its achievements. Behind this ideology of technological determinism lurks the unspoken belief that the days of designing for climate are over. Thus the unique character of local conditions, climatic variations, and orientation to light are all blithely ignored.

Tacitly reinforcing this disdain toward the natural environment is this country's attitude towards growth. As Architect Robert Knowles contends, relying on standardization as the most efficient way to build has resulted in a uniform physical environment—one of "low differentiation"—for the entire U.S. The condition further requires a high level of energy to maintain a "steady state" between homogenous physical forms and diverse physical environments.

Despite such insights and incessant talk of the "energy crisis", many architects still contend that the solution lies in merely *improving* the building performance, so that its mechanical and lighting systems work more efficiently. This may be true to a point. But the apparent logic in this statement also encourages dependence on a dwindling supply of traditional fuels to maintain the "steady state" between natural and man-made surroundings.

Vernacular architecture, on the other hand, aims for a state of balance *with* nature. Here, unselfconscious design reveals a strong sensitivity to daily and seasonal temperature variations, and to considerations of shape, orientation, structure, and terrain, that relate directly to the climate and microclimate.

Interestingly enough climatic factors needn't necessarily determine form. As anthropologist Amos Rapoport (*House, Form and Culture*) postulates, specific forms of the unselfconscious tradition derive more directly from socio-cultural factors than from climatological and materials constraints. Materials and climate determine, rather, what *is* possible within a particular context—a theory that explains why more than 300 house forms have emerged within nine basic climatic zones. These zones include the polar climate; marine climate (temperate, rainy); humid continental or temperate (cold winters, muggy warm summers); humid subtropical (mild winters, muggy hot summers); semi-arid subtropical (Mediterranean); semi-arid (little rain, fluctuating seasonal and daily temperatures); desert (windy, extreme daily and seasonal temperature fluctuations); tropical, arid and humid and tropical.

The following selection of houses, grouped according to similarities in climatic responses, emphasize solutions to thermal comfort, lighting, and ventilation. Of the environmental stresses at issue, society uses more energy to alleviate the physical stresses of heat, cold, and light, than to counteract mechanical forces such as wind, rain, snow. For example, a single family house in Southern California requires an average of 10,000 kilowatt hours per year, half of which is spent on air conditioning. If the house is heated by electricity, an extra 12,000 kilowatt hours is expended yearly.

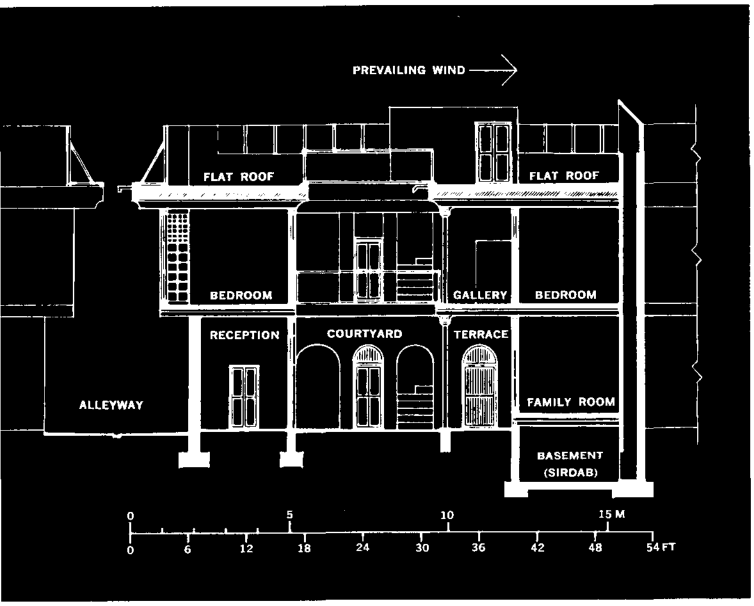
(Nevertheless houses are shown here that make ingenious use of indigenous natural materials to withstand mechanical forces. These examples serve as counterpoints to modern architects and builders who have tended to put too much faith in the ability of new materials to satisfy *any* range of mechanical requirements.)

It should be stressed that as ingenious as many of these designs are, no one expects architects to go back to using thatched roofs and mud walls, even though some would say it's not a bad idea. Rather, these examples are to be taken as reminders of a persisting pastoral ideal, and the need for a resolution between it and our advancing technological skill. This need, Leo Marx feels, has to be answered politically. But as sociologist Henri Lefebvre contends, (*Everyday Life in the Modern World*), the problem is also philosophical: "What philosophy does this society boast? This society devoted to the transitory, all-consuming, self-termed productivist ethic—inconstant and dynamic, worshipping balance, honoring stability and venerating coherence and structure—this incoherent society forever at a breaking point?"

But the resolution of these two contradictory trends should be attacked specifically at the level of design theory and implementation. To end the schism between technology and nature, design decisions must seek to be aware of the limitations of one, and the uses of the other. A self-critical architectural approach is required that does not relegate the physical nature of the site to the realm of die-hard romanticism nor forget the validity of primeval solutions. There can be no solace in the past except that its examples can energize our own search for basic values—indeed for a new vernacular with which to address the problems of our time.—SUZANNE STEPHENS.

2
The interest in architecture of the unselfconcious tradition was expressed by these early 20th century visitors to Mesa Verde, Colorado, an interest reflecting a pastoral impulse paralleling America's technological growth.

3

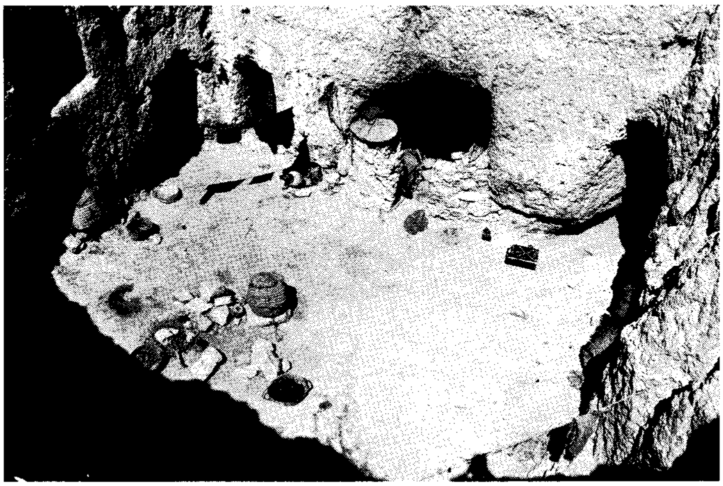


4

In Hyderabad-Sind, West Pakistan, high humidities and desert temperatures require that houses have good ventilation. With a high resistance to insolation —meaning low absorption of the sun's heat—the houses (3) are cooled by distinctive rooftop scoops, one to each room, which catch the southwest wind that is pulled through the house and out the lee windows by ambient breezes. The oriental courtyard house (4) is an elaborate, flexible response to the Iraq climate—hot summers, a large drop in temperature at night, mild winters, and low relative humidity. The projecting roof and bedroom (section) shade the alley and walls from direct insolation; likewise, the gallery and its roof shade the courtyard and its walls. The height of the courtyard minimizes direct exposure, while fountains, plants, and several daily sprinklings raise the humidity. Three-by-four-foot rooftop air scoops, oriented towards the northwesterly prevailing wind, ventilate the basement which is used for siestas. The incoming air is cooled by conduction from contact with the cold surfaces of the wind scoop shafts within a party wall that never receives direct sun. It is also humidified by passing over porous water jugs containing drinking water cooled by evaporation. The roofs are pitched toward the courtyard so rainwater may be collected in an underground cistern. External windows are small and few; sometimes sliding, perforated timber screens are used. Windows onto the court are more expansive.

5

6



7

8

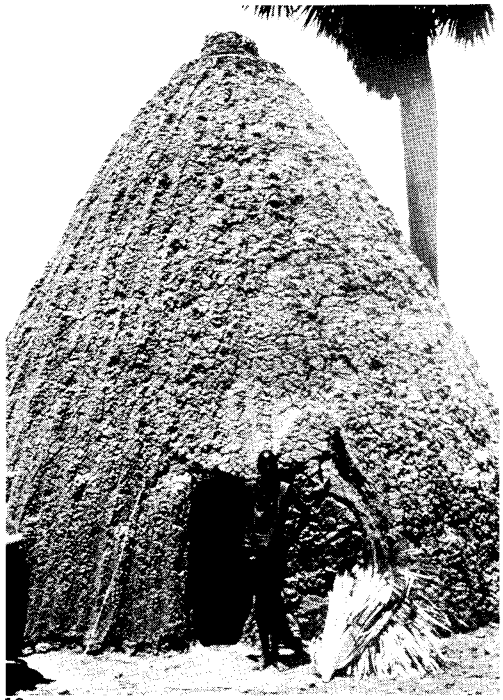
Among the more stunning examples of economical use of resources and climatic response are the Chinese and Tunisian artificial underground caves which combat strong winds. In Honan province (5), public squares are carved out of loess—an unstratified loam which crumbles easily. L-shaped stairs lead from the farmland above to habitations which are carved into the sides of the squares. Wind chill is minimized; relatively high subsoil temperatures are utilized. The courtyards are oriented to receive the maximum amount of low winter sun. At Matmata *in Tunisia (6, 7)* oval cavities, up to 200 feet in diameter and 30 feet deep, form the centers of neighborhoods of up to 100 people. Ramps tunnel up to the farmland above. Every chamber lies beneath at least 30 feet of earth, and is thus cooler than anything built on the surface. Underground life is uninterrupted by the violent windstorms common to the area. The village of Takrouna, Tunisia (8) combines the advantages of the above underground dwellings and the low-rise, high-density American Indian pueblo (9, 11). The one-story rectangular block, composed of stone barrel vaults and walls, manifests the scarcity of wood and need for insulation from heat and cold. The white stucco reflects heat and reduces drafts. The courtyards and winding streets resist fierce winds. Small, high openings on the exterior along with larger windows and doors on the courtyard aid ventilation. The clustering of these units, resulting in mutual shading, and the thick, heat absorbing masonry are comparable to those in pueblos.

9

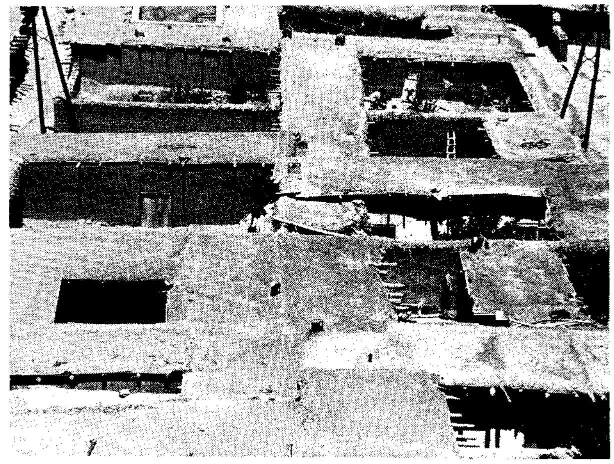
10

At Acoma, New Mexico (9), one of three pueblos thoroughly analysed from an energy point of view by Architect Ralph Knowles, the Indians seem to have knowingly exploited a southern orientation. The village is essentially three east-west rows of two or three tiered row houses. The highest tiers, at the north, expose the maximum wall and terrace surfaces to the southern winter sun. No building shades the work areas (the roofs) of its neighbors. Mr. Knowles has shown that the walls receiving winter sun have a high transmission coefficient and heat storage capacity; the terraces or roofs, receiving maximum summer sun, have a low thermal transmission coefficient and heat storage capacity. What all this means in simpler terms is that in summer there is a 43 percent increase in energy reaching the interior as compared with a 187 percent increase of incident energy on the outside surfaces. And that in winter there is a 50 percent increase of energy reaching the interior. The ghorfas (10), stone barrel vaulted structures in southern Tunisia, are imitation caves built by former troglodytes who were forced from their mountain caves to the valleys because of lack of food and water for their goats. Arranged in horizontal and vertical rows, sometimes reaching six stories, the ghorfas expose minimal surface to the sun. As in the pueblos, this clustering produces mutual shading. The masonry absorbs heat slowly, and hot air rises to the top of the vaults. Recently, for ventilation, small holes have been pierced in the rear walls which were originally completely closed. The most highly developed caves at Mesa Verde, Colorado (11) are those with a southern exposure. This, according to Mr. Knowles, implies that the wisest orientation to the sun enhanced the growth of the pueblos. Because of the siting, never more than one quarter of the Longhouse cave's inner surfaces are lighted during summer, whereas in winter only one quarter remains dark through the day. His study shows the buildings were placed so that walls and terraces received the low winter sun but were protected by shadows from the roof of the cave in summer. He has calculated that Longhouse is 56 percent more efficient as an energy collector in the winter than in the summer. In winter, solar energy received is only 12 percent less than in summer although the summer sun is in the sky 30 percent longer with about 50 percent less reduction of energy per hour due to the atmosphere. It appears at both Acoma and Longhouse that the Indians have gone far to collaborate with nature's energy and materials to equalize the seasonal and daily variations in temperature.

11



12



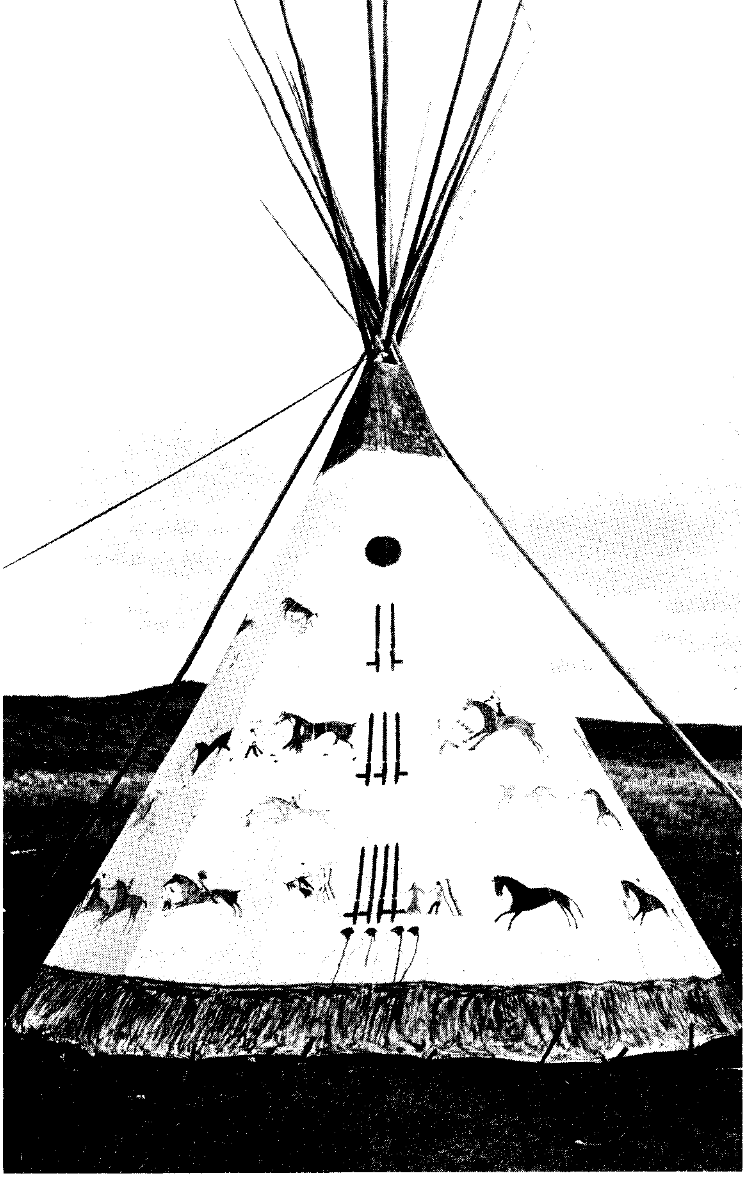
14

15

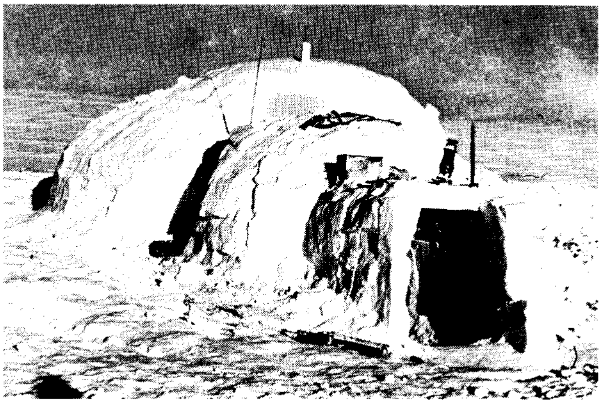
13

16

In the Njoue village of Chad in Africa (12) a beehive form of mud not only absorbs heat slowly in daytime and reradiates it at night, but allows room for heat to rise to the top. The Kenyan Masai snail-shaped hut (13) of twigs, cow dung and mud has the same thermal properties as any mud, mud mixture or stone structure. They are ideal in areas where temperatures rise greatly in the daytime and fall drastically at night. The extraordinarily beautiful form of the Masai hut (used mainly for sleeping) is said to be primarily defensive. The opening is only about four feet high so only one person can enter at a time—having to edge around a corner. Near Khenifra in Morocco the mud walls of a one-story atrium house (14) are protected during rains by the deep overhang of the mud and thatch roofs. Courts shaded and humidified by planting alternate with dryer, hotter courts which are cooled when their rising heated air draws cool air from the shady courts through the houses. The Navajo hogan (15), built in the same physical environment as the pueblo, by people with a similar economic and technological base, is just one indication of the wide variety of responses which take place within similar climates. Its mythological prototype was built of turquoise, white shell, abalone shell and jet—perhaps compensatory, as dreams sometimes are, for reality. The forked stick hogan, the oldest form, is made of logs bound at the apex, covered with sticks and plastered with mud. The door faces east to receive the first radiance of the sun. The summer hogan (16) is a shady, breezy shelter of brush leaning on a rectangular frame.



17



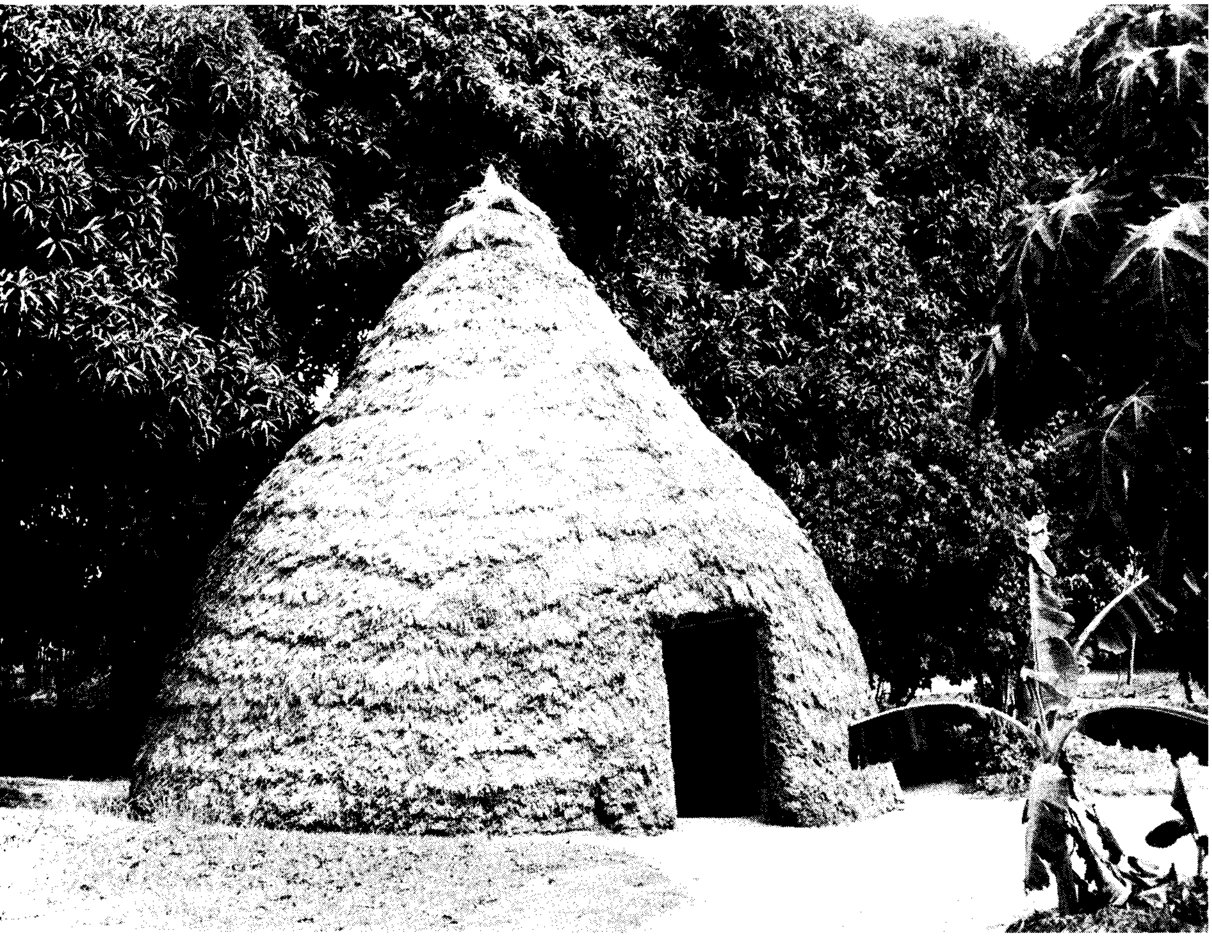
18

19

20

Lately, development of synthetics with resistance to fire, cold, chemicals, gases and pests, with both transparency and opacity to light and heat, have roused increasing interest in tensile structures. Among these the tent is light, easily assembled, dismantled and carried. The American Indian tepee (17) is one version that sometimes has ingenious flaps over the smoke hole at the top which may admit air, exclude wind and rain and retain heat. They are covered with hides and well insulated by a surrounding build-up of snow in winter. Ironically, in true American style, the tepee got bigger when horses became available to carry them. The yurt is an elaborate tent structure responsive to seasonal variations. It has a frame of wood lattice panels arranged in a circle, and a domical or conical roof of wooden ribs. Both are covered with felt mats: in summer, one layer of felt and one of canvas; in winter, as many as eight layers of felt, which makes the yurt comfortable even in gales and at 40 degrees below zero. (Lately plastic has been replacing the felt.) A variation on the yurt in Kalmuch, Russia (20) on the Lower Volga has sides which aren't felt covered. A typical Iranian tent (19) may be oriented to offer most protection from wind and sand. The igloo (18)—also temporary — is an exceptionally concentrated example of the skills of pre-industrial peoples. James Marston Fitch says, "Relative to the material resources and technological potentials of Eskimo culture, it represents an instrument of architectural intervention of simply astonishing precision and refinement." Not only is there little expenditure of energy in transporting materials to the site (only a snow-knife, oil lamp and skins must be carried) but the igloo demolishes itself, beginning to melt when the temperature goes above 20 degrees and collapsing above freezing. Ernest Schweibert says, "The Eskimos exist in climatological latitudes that still present them with Ice Age problems some ten months of the year." The igloo dome is constructed of a sloping spiral of snow blocks. It becomes stronger and more windproof by a glaze of ice that forms on the interior because of body heat and an oil lamp. This ice is also a radiant heat reflector, like foil on insulation, and is a smooth and durable floor covering. The dome offers maximum resistance to winter winds and exposes the minimum surface to their chilling effect. It encloses the largest volume with the least material and forms a shape that has no cold spots in relation to a radiant point source of heat. By draping the interior with skins and furs, the Eskimo prevents body chill from radiant and conductive heat loss to the floor and walls. Stove and body radiation are such that with outside temperatures of 30 degrees below zero inside ambient temperatures can reach 65 and men and women are usually bare to the waist when indoors. The smoke hole is on the lee side of the center block allowing the wind to draw the smoke out from inside.

21



22

23

Thatch is used in staid, sublime and comical ways in diverse climates. In Nigeria, a Kirdi roof looks like a lady who's just taken rollers out of her hair. Others handle thatch sculpturally, as if it were clay. And some use it for false pretenses. In the hot, humid Amazon, several tribes, according to Amos Rapoport, live in thickly thatched, large communal houses with no provision for cross-ventilation. He can only conclude that although the thatch may provide good protection from insects, it was borrowed from some more powerful culture for status reasons and makes climatological nonsense. Among the most minimal shelters is the Yagua dwelling (21), a frame without walls topped by thatch. The elegant hut in hot, humid Chagga, Tanzania (22) provides good insulation because of the thickness of the thatch which also acts as a reflector. By contracting when it is dry the thatch allows ventilation; and expanding when wet it becomes waterproof. Its shape is particularly good for handling torrential rains. In the Fiji islands (23), overhangs are minimized to resist the uplift of strong storms but if the house does collapse the roof usually remains in one piece, providing shelter from the accompanying heavy rains. The woven walls are true curtain walls. In contrast, stone walls and thatch are used for their insulating properties in cool climates in Andalusia (24), Ireland (25) and England. A sporting thatch hut in Alto Bonito, Colombia sports a verandah. They are made of various materials in various climates, shade walls and windows. Allowing ventilation during heavy storms, they also provide sleeping and sitting space for transitional seasons.

24

26

25

28

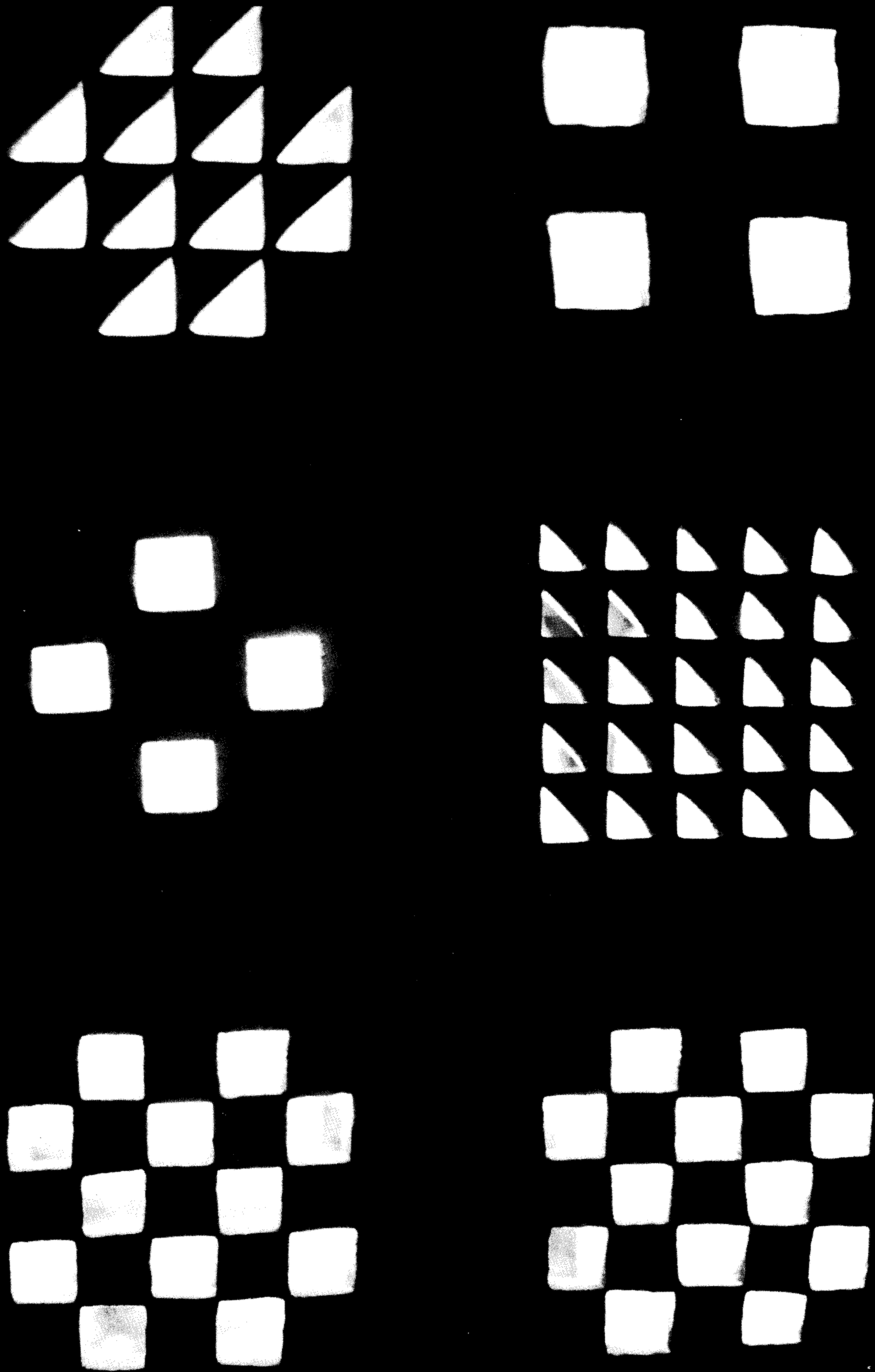
29

27

30

A marvelously exaggerated form of the stilt house is found in the Gaddanes tree house (27) in the Philippines which looks as if someone blew his wig in high dudgeon—it's 40 feet off the jungle floor. It nevertheless is typical of stilt houses in humid climates with moderate and constant temperatures and heavy rainfall. The roof dominates and slopes steeply with wide overhangs to cope with torrential rains. It is opaque to the sun and of minimum mass to avoid heat build up by absorption and consequent reradiation. Frequently there are no walls, or half or perforated walls for maximum ventilation which is enhanced by breezes flowing under the building. Additionally stilts protect against floods, insects, animals and people. A more conservative form, also Philippine, is that of the Moros (28). In the Admiralty Islands (29) the Manus protect themselves well from rain and sun with clear cross-ventilation beneath the low eaves. The African tribesmen near Yaounde in the Camaroons used stilts to build above a swamp (30). Another age-old device (which has fallen into bad hands in the west lately) is the screen which provides shade, privacy with a view, and penetration of breezes. The exterior wall of the 11th century Jain temple, Vimala (31), on top of Mt. Abu west of Agra, India, is a screen carved out of solid stone. Its geometry is a strong counterpoint to the expected elaborate curvilinear carving of the arcade.—JANET BLOOM.

PHOTOGRAPHS: 1, Magnum (G. Roger); 2, The Bettmann Archive; 3, Alfred Nawrath: Unsterbliches Indien, Verlag Anton Schroll & Co., Vienna; 4, Shelter And Society, Praeger Publishers and Barrie & Jenkins Ltd.; 5, Wulf-Diether Graf zu Castel, Munich/Riem; 6, 7, 8, 10, 14, 24 Myron Henry Goldfinger; 9, 11, 12, 15, 16, 17, 18, 20, 21, 23, 26, 27, 28, 29 courtesy The American Museum Of Natural History; 13, 22 United Nations Centre for Housing, Building and Planning; 19, 30 courtesy of the United Nations; 25, courtesy Irish Tourist Board; 31, Tim Prentice.



LIGHTING SOME CANDLES

Answering the energy question
will alter the look
and outlook of our society

It doesn't matter which clock or calendar you go by.

Chinese, Mayan, Gregorian.

Encompassing them is the truth Einstein perceived: Time is relative to speed. And if, by some feat, we move toward the speed of light, time will slow.

Atomic clocks have verified Einstein's perception. So have the facts of 20th century existence—an existence in which the clocks are winding down.

These facts have been woven (perhaps woven themselves) into forces which impinge on our daily lives at frenetic frequencies: technological, social, cultural, economic, even moral. In an era of rampant urbanization, these forces invade, we evade, running like lemmings toward a frozen, fenced-in aloofness from reality.

It would seem that our intrinsic capacity to choose evasion has nullified our capacity for much else. And this is nowhere more clear than in our stewardship of energy.

Like it or not, the "cosmic harmonies" which Kepler talked about hundreds of years ago, have been clocking our actions, or lack of them. The chaos we have created in our haste and expediency, in our ungodly and gluttonous pursuit of material gain, is resulting in a very real winding down of our clocks, and our capacities. In a very pragmatic sense, we must take full advantage of the "extra" time which those "cosmic harmonies" have bestowed, full advantage of the tolerance being offered. But this increment of mercy, this time for reassessment and reorganization, will be warped unless we can summon the resolve (an essential form of energy) to face our myriad problems as though they are cut from the same cloth—the resolve so implicitly, exquisitely **there** in the scientific laws that have indulged our abuse of them.

William Blake had it right: "If the doors of perception were cleansed, everything would appear to man as it is, infinite. For man has closed himself up, till he sees all things thru' chinks of his cavern."

Emerging from that cavern, dealing directly with the laws which govern the generation *of energy, dealing* directly with our collective abuse of it, it is clear that nature is being more generous than we have any right to expect. Getting a handle on infinity, cleansing "the doors of perception," sorting out the present and potential sources of energy, we will, as a matter of course, move into closer proximity with nature—and more fully comprehend our place in stewarding its elements in a responsible (even reverential) manner. That closer proximity, attaining it and expressing it, is a function of science and art—increasingly, **one** function, as the physical and metaphysical needs of man converge.

So we are at a point of relearning some of the very simplest things about ourselves, at the same time we must harness some of the most complex means to sustain ourselves.

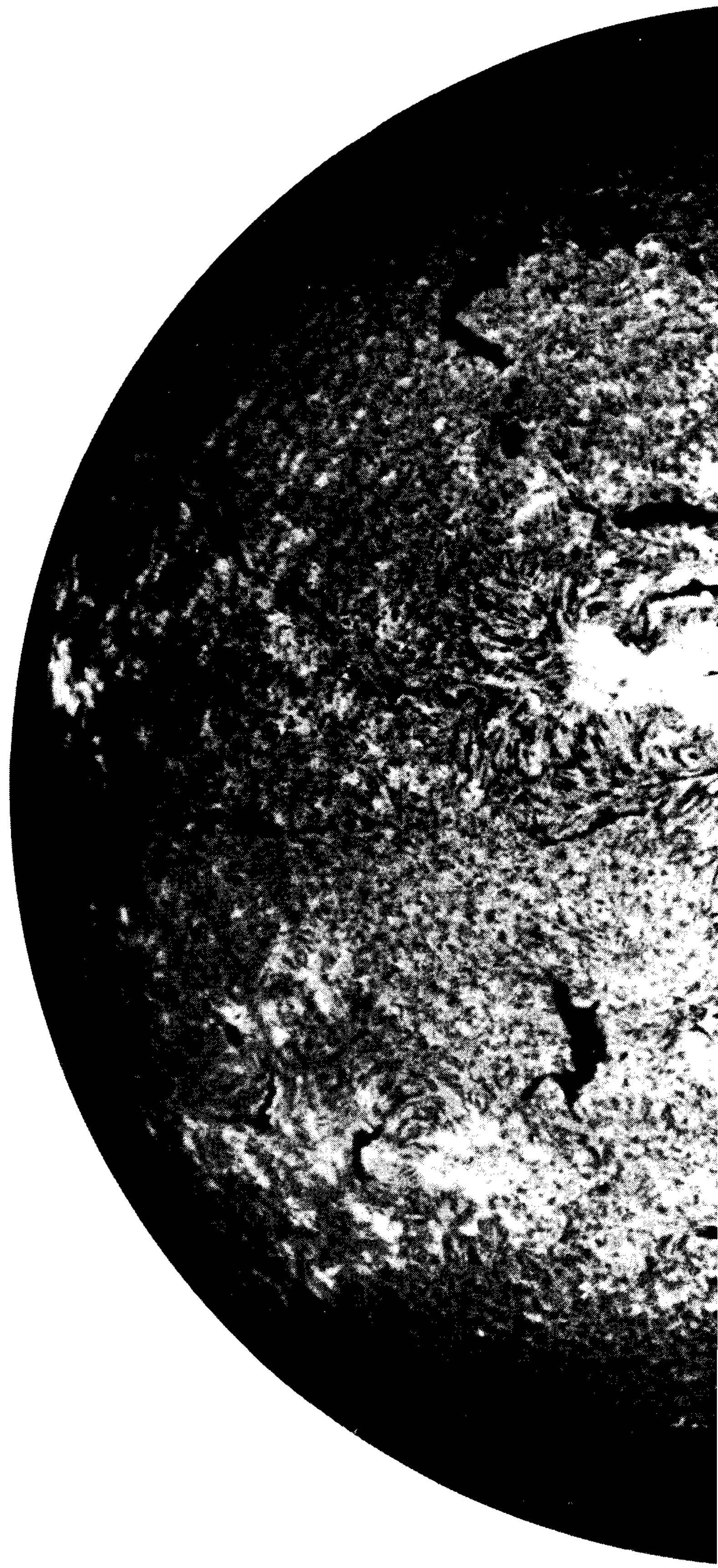
What are the sources of sustenance?

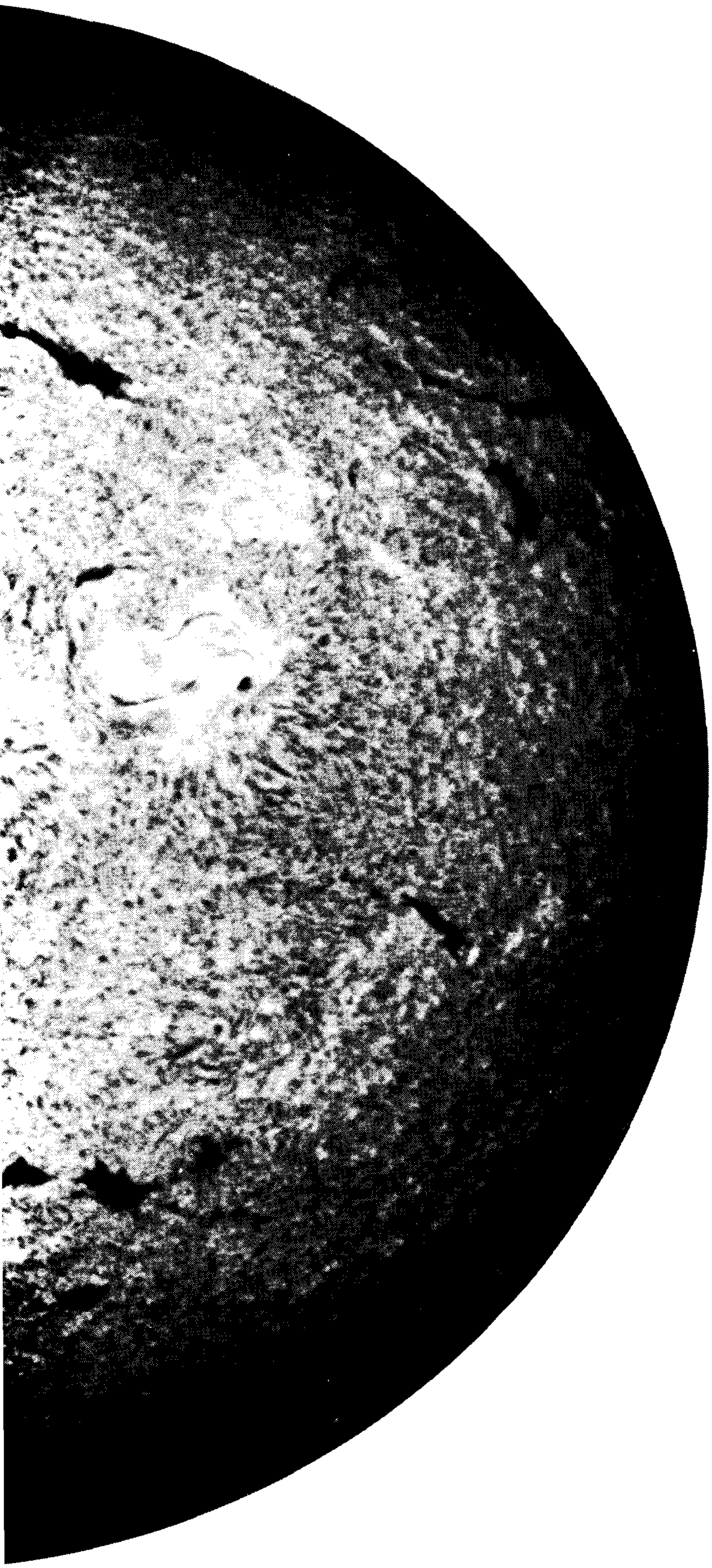
Looking to the next century, we will need energy that is nonpolluting and limitless; and already, the feasibility of nuclear fusion has been shown—hopefully to be in applied research by the 1980's. Looking to the next 30 to 50 years, we will need energy that is abundant, usable, safe; if the safety bugs can be worked out, the fission "breeder" reactor is a good bet, though hotly contested by environmentalists (and some utilities) who are hotly lobbying for a stepped up fusion program. Right now, as no one needs to be told, we need energy that is cheap, convenient—coal and oil. In addition, a number of other sources are being looked into and, in some areas, tried: These include geothermal power, plumbed from deep in the earth's crust—now supplying energy in some parts of California and, elsewhere, New Zealand. Also promising as a supply for much day-to-day energy needs are the sources of wind and the sun. These last two, though less adaptable as central energy sources serving a large region, may well be a key to supplying space heating and cooling on a local basis. In the case of solar power, Dr. Jerome Weingart of the California Institute of Technology has calculated that if two-thirds of the homes in the U.S. were solar equipped, more energy would be saved each year than is currently produced by all the electric power plants in the country.

The utilities need not feel challenged, however—at least not by wind and solar power. Their organizations will still have to steward the production and distribution of nuclear power—and are gearing up for its ultimate form, fusion, which approximates the internal reactor of our own sun.

Not so long ago, fusion was considered a hopelessly futuristic idea. And the U.S., after a brief theoretical stab, left the field to the Soviet Union which has made stunning progress.

The primary fusion fuel will be deuterium—a double isotope of hydrogen, and extractable from seawater at the rate of one-half gram per gallon. Scientists estimate that a half gram of deuterium equals 300 gallons of gasoline, and that





the fusion energy available from one cubic kilometer of seawater equals 2,000-billion barrels of oil. According to current figures, that equals the world's entire oil reserve.

Several fusion reactions are theoretically possible, but two are being concentrated on within the suicidal limits of the U.S. scientific research budget. One is the fusion of deuterium with hydrogen's triple isotope tritium. The other is the fusion of two atoms of deuterium. In both cases, an almost perfect vacuum must be achieved, along with almost incomprehensible temperatures, to sustain the reaction long enough for energy to be extracted. What's more, it won't be done for nothing. The Atomic Energy Commission says that a go-for-broke fusion program would require a national outlay of $900-million between now and 1980—this, just to get fusion into the laboratory, beyond feasibility.

But considering the stakes, and the theoretical attainment of 80-90 percent efficiencies, the U.S. might do well to think about whether we wouldn't be going broke without undertaking the fusion challenge. Americans have spent many times $900-million on other ventures—often without their knowledge or approval, including the Indo-China experience, which cost almost $30-billion. The obvious dividends of fusion, the consensus that it could now be perfected well before the turn of the century, make it a compelling alternative to the fission "breeder" which has, until very recently, been considered the ultimate interim source of nuclear energy.

While it is true that the "breeder" can theoretically produce more fuel than it uses, hence the name, it is also true there are unacceptable safety hazards which the Atomic Energy Commission has been climbing walls to solve. The major "breeder" fuel would be plutonium, which has a half life of 25,000 years. And it is no exaggeration that any decision to go with it must also carry a responsibility for that plutonium a good 25,000 years into the future.

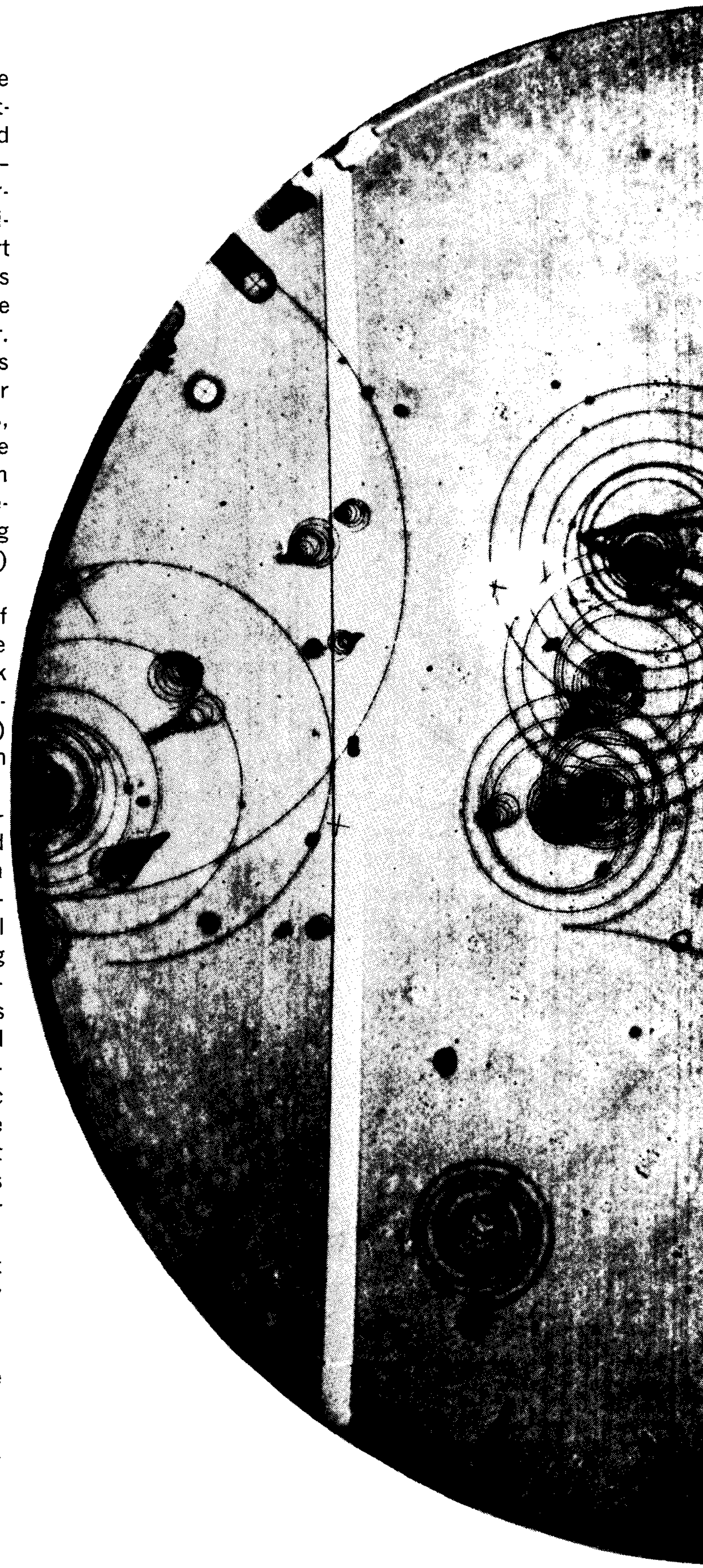
By contrast, scientists agree that once the fusion reaction is captured and sustained, deuterium converging with deuterium would carry little, if any such danger—neither in the form of heat or radiation. All of which is why many groups—consumers as well as producers—are urging that the U.S. "skip" the problematical fission process, for which no working prototypes yet exist, move up the point of penetration into the fusion epoch, and meanwhile stretch the fossil fuels with supplementary supplies from wind and solar power.

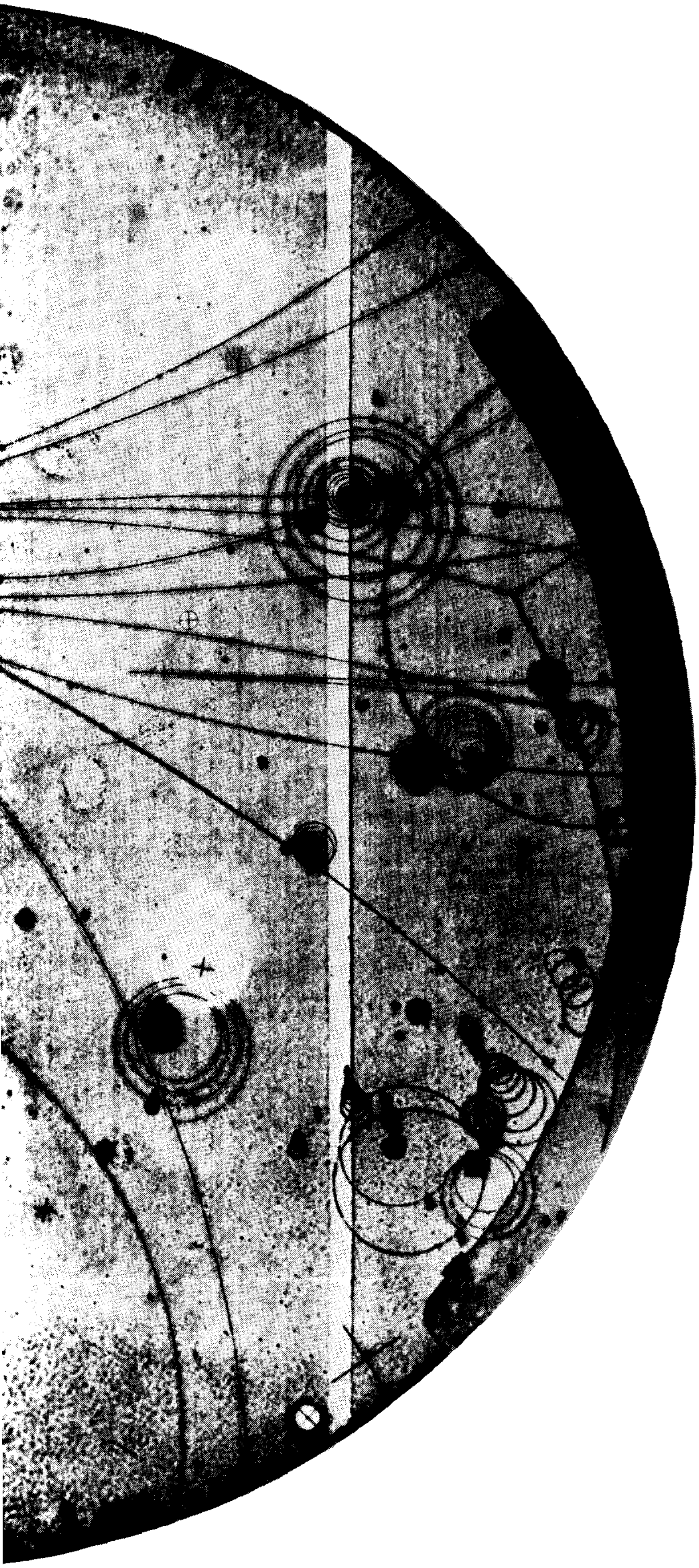
All this is going to take time, but let's remember that we don't have much. Unless the U.S. stops seeing all things through the chinks of its cavern, sorts out the mix of energy sources, and sets priorities and schedules, all experts we have consulted agree that our "Long Day's Journey Into Night," with attending physical and psychic disaster, will occur by the mid-1980's. So far, the U.S. Government has gone through the motions of setting up an energy policy, appointed an energy czar (former Colorado governor John Love), and has come out strongly for stretching the fossil fuels—especially oil. At the same time, research budgets for perfecting new, nonpolluting uses of coal (an increasingly credible standby once sulfur can be extracted) are nothing short of a mockery of the problems we face—and of our means to solve them. This Scrooge syndrome also applies at the level of synthetic fuels (petro-chemicals), fusion and solar. For example, federal funding for the synthetic sources is now $20-million a year; for fusion, $33-million; for solar power, only $5-million. If you bother to add these figures, you will find they come to $58-million, which is what the U.S. House of Representatives recently decided to spend on extending the West Front of the Capitol. There was no debate, of course, about how Congress will go about getting heat and light, circa 1985, for such new (and unneeded) offices.

So, while both the Executive and Legislative branches of government go through the drill—especially the off-shore variety, other sources are being short-changed while slick tricks are being pulled on the American public by a consortium of oil producers (recently indicted by a Florida court) who report oil shortages on one hand and soaring profits on the other.

This coercion is being cracked—cracked open by circumstance. Over 2,000 independent gas stations have closed this year, as one bit of evidence. Try buying more than ten gallons on, say, the Connecticut turnpike, as another. Despite evidence, the attitudes of those who control our oil reserves seem to be as fossilized as their fuel. And sitting under an upturned barrel, they have America's energy situation over one. Just as transportation (and money for it) has been so long synonymous with highways, so has energy (and money for it) been synonymous with oil. And unless the research budgets are cracked, along with this monopolistic lobby, our singular, governmentally condoned dependence on oil may well grease the skids into oblivion—one brought on by our unpreparedness to adapt to new energy sources at the strategic time, one brought on by what Buckminster Fuller recently called "the greatest heist in history."

Adaptability seems to be the key in meeting our present and upcoming challenge. And adaptability calls for an energy economy that is diverse in its sources as opposed to one-sided in orientation. This means creating (and legislating) a mix of energy sources; down the road, by not as far as we thought, fusion; near at hand, a cleaner composite of coal and oil; and, again, supplementing these into the foreseeable future, wind and solar energy, both subject to funding





and refinement but with the basic technology already well in hand.

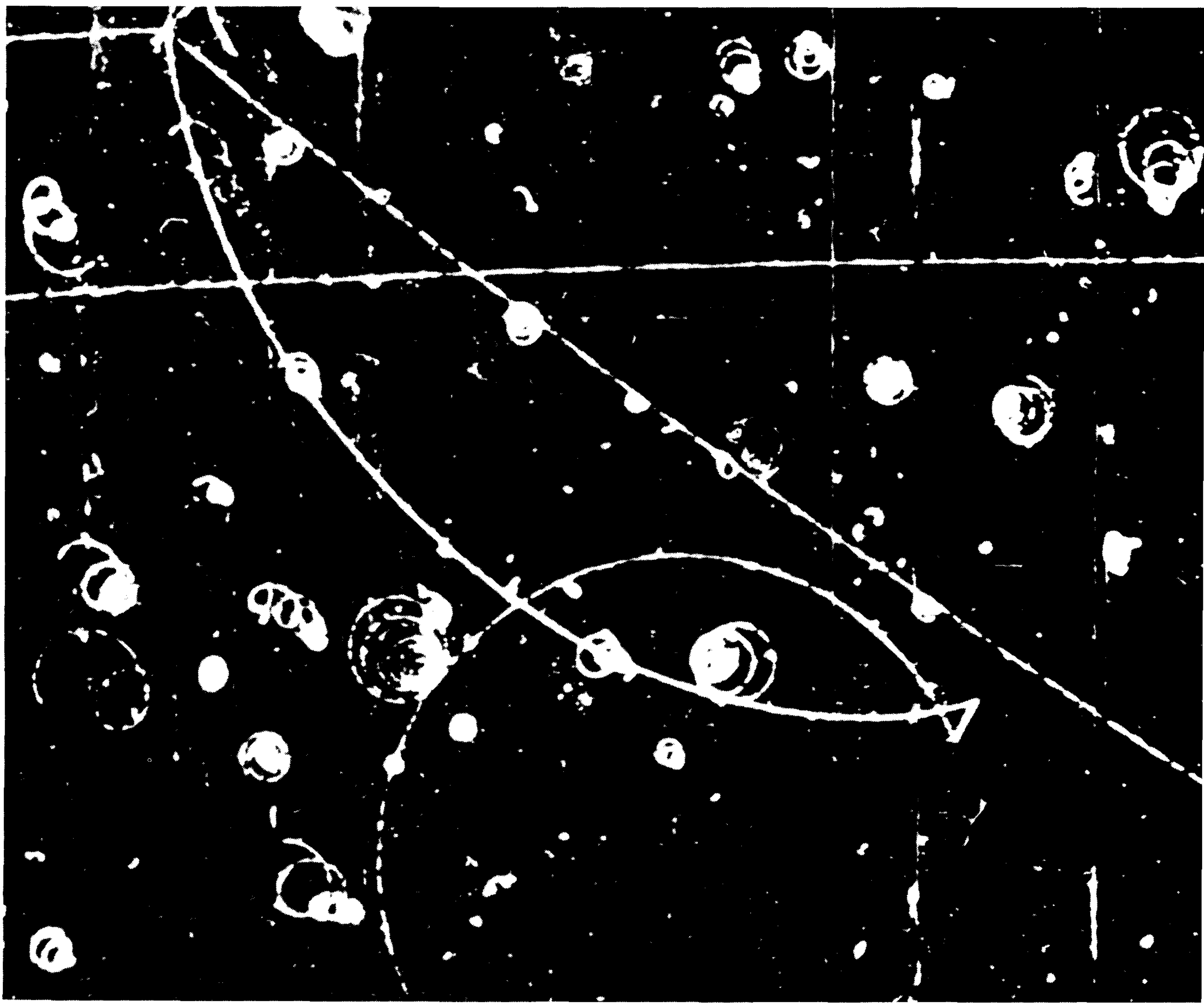
As for the lingering generation of nuclear fission reactors, it must be said, after a thorough look at experience across the country, that the utilities are becoming as impatient with them as the environmentalists. For various reasons, it takes seven to ten years to put a plant into operation—even without the class-action suits which are now so au currant. Further, we have found a widespread sense of responsibility on the part of utility spokesmen, and especially among the scientists and engineers whom utilities employ—a responsibility which is reading out in the form of more careful procedures, endless testing and (a little surprising) a less testy attitude toward the real, well-documented concerns of environmental organizations.

Several scientists we talked to, especially in Illinois where Commonwealth Edison has long led the field in nuclear consumer energy, admitted that the now-traditional fission plant was too often painted as an unqualified blessing—a Trojan Horse, as one put it. Severe citizen surveillance has not only curbed any cutting of safety corners which might have occurred but also forced a reassessment within the utilities themselves. This is one reason, and perhaps the most convincing one, that leading utility executives are urging a stepped up entry into fusion technology and are, generally, exercizing great effort to make the existing generation of fission plants as safe and productive as possible until the "ultimate" source is tapped.

This viewpoint is an attempt, perhaps futile, to play down the rancor of recent years—the rancor which has divided people between the exploiters of environment and the saviors of environment, each with its array of scientific expertise and ideology, each with its aspersions cast on the other. We have discovered that it is wrong, dead wrong, to classify people, companies, groups into such "camps" without tolerance for the context in which vested interests (environmental as well as corporate) must conduct their affairs. And if it seemed, a few moments ago, that we were "going after" oil and letting off the utilities scot-free, it is because we discerned an especial lack of tolerance among the former, and a marked openness (if not always agreement) among the latter. Environmentalists, we submit, might do well to understand such tolerance—especially those who inveigh against technology by way of electric typewriters—remembering, as someone we can't recall put it: "Whenever technology reaches its true fulfillment, it disappears."

This disappearing act, by the way, may well be one of the dividends of some of the energy sources mentioned: Wind, solar, fusion. Once attained and applied, all promise a visual cleansing of our physical environment, along with a cleansing of pollutants. The reason is that you have to get energy around, once it is generated. So far, we have been getting energy around by way of wires—not exclusively so, but to the extent that wires (mostly overhead, along our streetscapes) have become ruinous visually, and expensive to maintain. Wind, solar and fusion power will have no need of such technological clap-trap, the kind now competing with the natural landscape from Cape Cod to Big Sur. A 20th or 21st century windmill, supplying power to a house or a cluster of them, will impinge on the view, but barely so. Solar equipment, built into a house (perhaps with an FHA mortgage?) will be scarcely noticeable—except somewhere on the roof ridge. A fusion generator, scientists explain, would be little more than a crisp, metallic box in an obscure location (like your office building basement). The evidence of technology might also disappear in those energy sources already at hand—especially coal. The coal conversion processes need refinement, but we know what to do, given the money to perfect it—namely, get the sulfur out of the coal before it is burned or get it out of the smokestacks after it is burned. It has been estimated that we throw *as much sulfur* into the atmosphere every year (by way of emitted sulfur dioxides) as we take out of sulfur mines. The revived use of coal, once downgraded in favor of nuclear energy and complicated by recent environmental legislation, could—if properly funded—energize another industry, sulfur. Environmental constraints, viewed with a profit motive, can become sources of new business—sources which business itself might not have otherwise grasped.

As has been documented elsewhere in this issue, the energy mix or make-up will also have a lot to do with the way we live—especially with the way our shelter and settlements appear. While it is within our potential to have unlimited sources of power, the current energy crunch has forced those who design and build the physical environment to rethink the basic values upon which the design and building

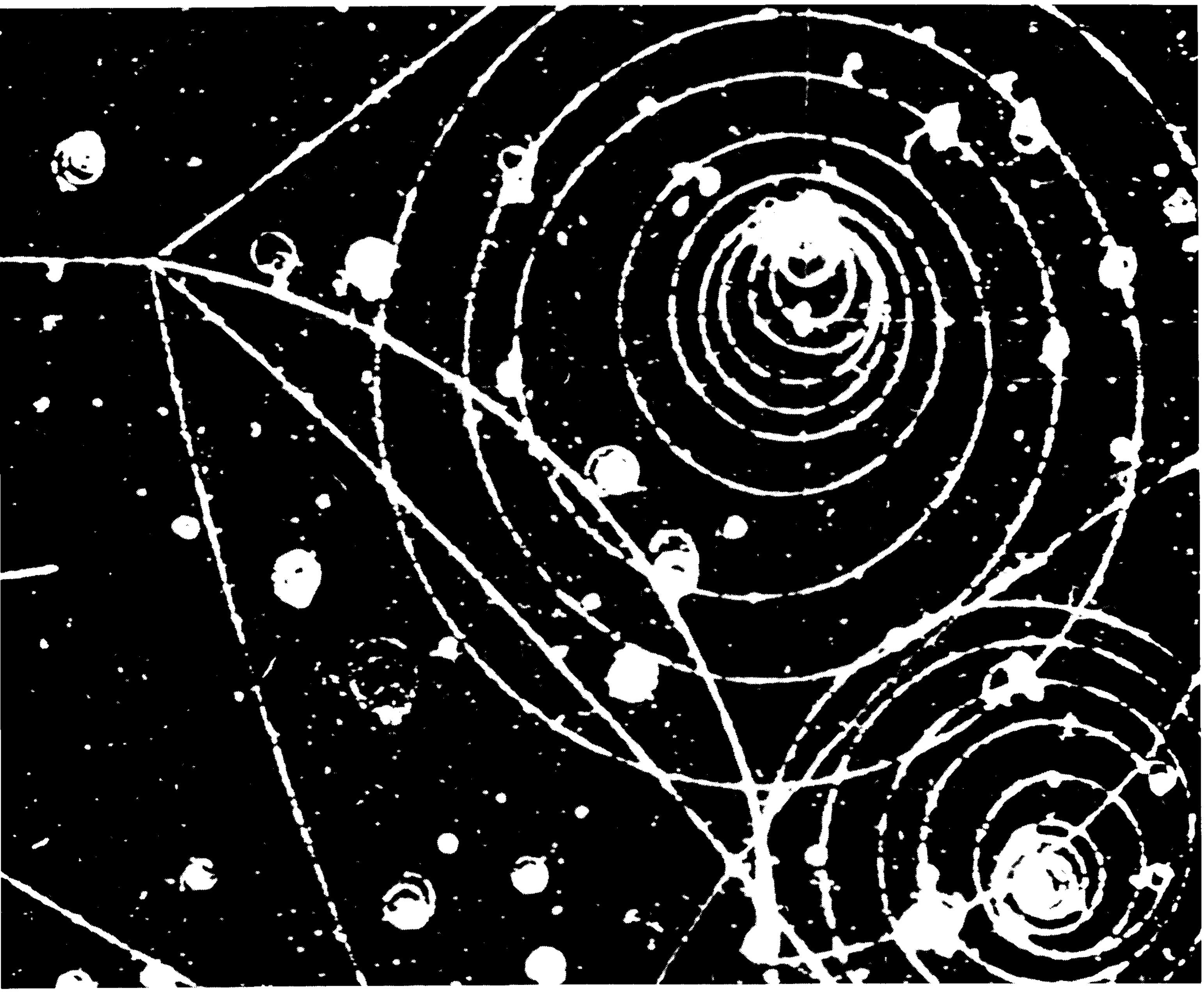


process *is based.* It is ironical indeed that the so-called crisis, that of energy shortages, should now call our attention to fundamental design issues—the ones which should have been calling architects and allied professionals to task long ago, the ones concerning human scale, those concerning our demonstrated need for an environment which allows choice and differentiation.

Architect Richard Stein, earlier in these pages, spells out the range of responsibilities which architects must take in conserving energy. He further spells out the role which architects must play in concert with those who finance and develop buildings. But it should be further stressed that any reformation in design attitudes should not be undertaken merely to conserve existing energy supplies until there are limitless ones. It is, rather, a reformation which should have occurred in any case, one called for over the last couple decades by those who realized that our environment was, in Ada Louise Huxtable's words, being "sealed into sterility."

Richard Stein has rightly called for a design approach by which cost and quality can be gauged over the long term —and energy has been, of late, the primary impetus behind this life-cycle costing. Those of us who have been advocating design quality for other than energy reasons have been given a shot in the arm. And the upshot of the "crisis," at least in architectural terms, may turn out to be an emphasis, at the hardest levels, on those soft, humanistic qualities so many of us have been pushing for. For if we are to have a physical environment which allows differentiation of energy use—that is, one designed to allow you to turn out the light when you are not using it—we will tend to have an environment which is differentiated in several other ways. We will tend to have an environment where windows can be opened, an environment oriented to prevailing breezes and the movement of the sun, an environment in closer proximity with nature—the proximity we called for at the outset.

If energy conservation were our only standard, we might



opt for low-rise, high-density development, with communities clustered together; with retail, community and residential shelter carefully composed for easy access from one to the other; with an environment alive 18 or 20 hours a day instead of just eight—the typical office building environment.

Without energy as an element of concern, there have been solid social and economic reasons for such clustering all along—reasons having to do with heightening the interaction between people, those having to do with conserving the character of the land and of the cityscape, those having to do with endowing a sense of place and identity for people who have otherwise languished in artificial privacy behind the barriers of "open-office landscaping" or on quarter-acre lots "away from it all."

The truth is that everything which architects are doing today to help alleviate the energy shortage should have been done without it. And several of the examples brought to our attention, while conserving energy, while built in record time, while evoking new materials, were brought to our attention as examples of getting maximum rental floor area fast, or as examples of how to maximize short-term profit, or as examples of how to make a killing on resale. Other examples brought to our attention embodied sound thinking and far-seeing innovation with respect to either wind or solar power—but innovative energy techniques have not as yet created a new architecture, and we are forced, after all is said and done, to wonder whether energy, as a technical concern, can create a new architecture. Indeed, we are forced to the conclusion that it cannot.

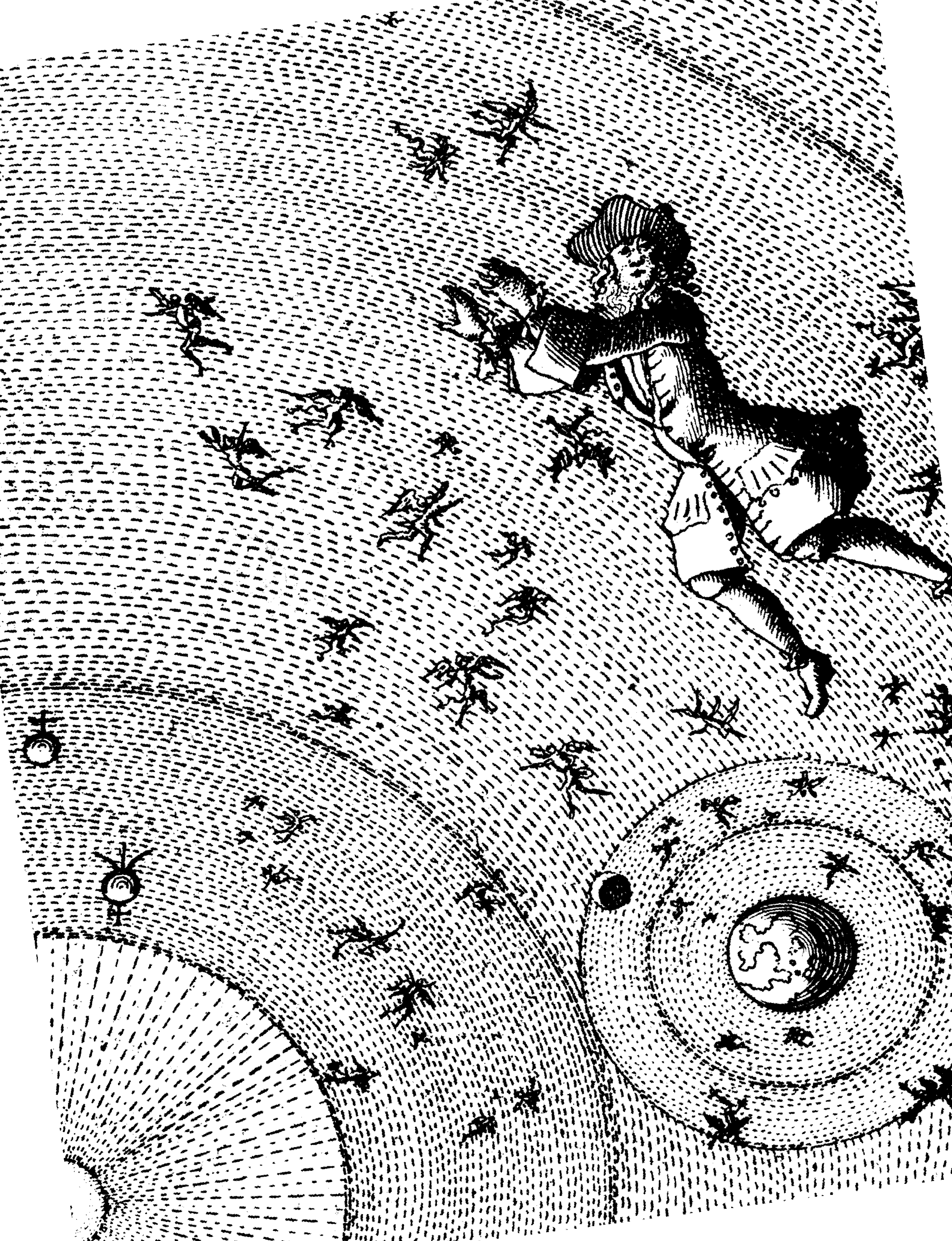
Energy, as a philosophical concern, can. We have only to look carefully through the writings and buildings of history's most decisive architects to understand their grasp of natural elements—their uses of light, their accommodation of the landscape, their comprehension of climate, and (perhaps most crucially) their understanding that human emotion is the most tangible building element of all.

In architecture, as in the varied aspects of life which it embodies, energy is partially that which goes into something and partially that which comes out, partially that which architecture allows to happen, or inspires. "Energy," as William Blake also said, "is eternal delight," but the question remains whether or not man, given all the energy he needs, will have learned enough to make delight and dignity the regenerative aspects of architecture, or learned that the energy to elevate man's emotions and attitudes was really at hand all along.

The sun is half the world, half everything,
The bodiless half. There is always this bodiless half,
This illumination, this elevation, this future. . . .

—WALLACE STEVENS

PHOTOGRAPHS: page 88, Norman Matheny, The Christian Science Monitor; page 90, Wide World Photos; page 92, Stanford University; page 94, Lawrence Radiston Laboratory; page 97, Bettmann Archive.



FACETS

(Continued from page 32)

the Dirksen Federal Building and a post office. The complex was designed by Mies van der Rohe.

Within four blocks of the Federal Complex are a 50 ft. sculpture by Picasso in front of the Civic Center and a mural by Marc Chagall under construction for the plaza of the First National Bank.

WASHINGTON

HUD SLAMS PROPERTY TAX

Property tax inequities are a direct cause of the decay of property in cities, says a report made for HUD. These inequities, stemming from poor property tax administration in ten of the country's largest cities, are also some of the reasons why minorities have trouble owning urban property, according to the report. It was put together by Sens. Charles H. Percy (R) of Illinois and Edmund S. Muskie (D) of Maine, and it analyzes the property tax-urban decay relationship in Atlanta, Baltimore, Chicago, Detroit, Nashville, Oklahoma City, Philadelphia, Portland, Ore., Providence, R. I., and San Francisco.

Sometimes the taxes carried in blighted neighboorhoods are ridiculously higher than in more proper ones. For example, according to the report: "In Baltimore, Chicago, and Philadelphia, properties in blighted neighborhoods carry ten times the tax burden of properties in upward transitional neighborhoods."

Acting on the report's findings, Senators Percy and Muskie have introduced legislation designed to help state and local governments reform property assessment.

BY-PRODUCTS

THE ARCHITECTURAL INDEX

In its 23rd year of publication *The Architectural Index* is now available for 1972. Listed are articles from THE FORUM and the other U. S. architectural journals; projects are cross indexed according to location, general building type, and architect or designer. The 1972 *Index* costs $7.00 and can be ordered from *The Architectural Index*, P. O. Box 1168, Boulder, Colorado 80302.

FRONTIERS

COLLEGE UNDER VINYL

Air structures may or may not be coming of age. But this one located in a meadow in Columbia, Md., will be a regional campus for Antioch College in the fall. It was put up by Antioch students and professors in four days at an estimated $5.50 a square foot, compared with from $20 to $40 a square foot for permanent educational structures in Maryland today. It is expected to last for five years.

Antioch's pneumatic campus.

Inside there are smaller auxiliary air structures to serve as offices and there are ramps of bricks leading from one terraced level to another. In all, the translucent vinyl structure covers 32,400 sq. ft. at heights varying from 15 ft. to 25 ft. Inflated in November 1972, it was to be the site of the First National Conference on Air Structures in Education this spring. But interior temperatures above 126 degrees (the point at which the thermometer burst) forced the 400 conferees to assemble at a motel at Baltimore's Friendship Airport.

Research and design costs were covered by a $36,200 grant from the Ford Foundation's Educational Facilities Laboratory and by $100,000 from the Federal Office of Education. Construction costs of $179,000 were paid by Antioch.

How will students like going to college in an air bubble? Not too much, judging from preliminary reports. One student involved in the project called it "more a piece of art than a functional work of environmental design." A teacher, who quit because he thinks the structure will never be finished, feels psychological studies on the effects of the bubble as educational environment should have been done. Students will evidently have to adapt to the structure, a process of education often not considered in more conventional buildings.

DISCOURSE

A LITERARY RAMBLE

Abigail Ann Hamblen, a Massachusetts lady concerned with literature and architecture, sent us this study she's done on the architectural imagery in The Golden Bowl, *a novel Henry James published in* 1904, *revealing his great love for architecture and its special role in his work:*

Any student of Henry James knows that each of his novels was carefully planned before he started its actual composition. He was nothing if not methodical in his writing, and his plots were blocked out with a nice feeling for symmetry and contrast. The more one thinks of his methods, the more one sees an affinity with architecture.

Aldous Huxley, in *Antic Hay*, has Theodore Gumbril, Sr., point out the difference between architecture and the other arts. His rather whimsical discussion is worth quoting at length, for it has here a peculiar relevancy:

A Max Beerbohm caricature of Henry James.

"The fact is," he says, "that architecture is a more difficult and intellectual art than music. Music—that's just a faculty you're born with, as you might be born with a snub nose. But the sense of plastic beauty—though that's, of course, also an inborn faculty—is something that has to be developed and intellectually ripened. It's an affair of the mind . . . A man can be an excellent musician and a perfect imbecile. But a good architect must also be a man of sense, a man who knows how to think and how to profit by experience . . ."

Reading the above with James' work in mind, we realize just how close he, as artist-writer, was to the artist-architect—the necessary cerebral quality, the painstaking blueprinting, the understanding of reality and, in spite of that, a reaching upward.

All of these are especially apparent in *The Golden Bowl*. Most noticeable at first is the proportion of the book, with almost equal space devoted to the consciousness of the Prince and that of the Princess. At the beginning we are introduced to the Prince and Charlotte, told of their former love affair, and informed of the close relationship of Maggie Verver and her father. Next comes the marriage of Maggie and the Prince, followed by the marriage of Charlotte and Maggie's father. The adultery of the Prince and

(Continued on page 100)

Designed by Robert Giese / Renquist Assoc. Inc.

FACETS

(*Continued from page 98*)

Charlotte eventually erects itself squarely upon this many-pillared pedestal.

The novel abounds in figures of speech that pertain to architecture. The great number of them are casual, seemingly off-hand. For instance, the Prince's ancestor, an infamous Pope, is referred to as "the palace builder." But many references to buildings and rooms are integral parts of the story, settings that enhance the significance of given moments. James is unusually practiced in the skill of every good fiction writer, that of relating environment to action and thought.

For instance, we first see Adam Verver in the billiard room at Fawns, alone "in the vast, square clean apartment" with its "large clear windows." And, as the story proceeds, we realize just how appropriate such a background is for this large-souled man.

Later, the plan of the house at Fawns enables James to describe one of his most impressive scenes. It is night. Maggie has left the others playing bridge, and has gone out on the terrace to walk up and down past the French windows.

Trembling with the consciousness of her marital situation, she walks along, looking in to see the absorbed card players, then the empty drawing room. The light from the splendid rooms shines out in long shafts, accentuating the darkness of the terrace, the loneliness of the small figure. And then she sees, tall, queenly, assured, her adversary coming toward her. In the dark outside is the beginning of the end.

An extraordinary number of architectural figures are used to convey the persons and the personalities of the two chief male characters. Those employed for the Prince are especially picturesque. The young man's "dark blue eyes were of the finest, and, on occasion, precisely, resembled nothing so much as the high windows of a Roman palace, of an historic front by one of the great old designers, thrown open on a feast-day to the golden air."

Whimsically, in a figure that later becomes very significant, he explains his "moral sense" to Mrs. Assingham: "I've of course something that in our poor dear backward old Rome sufficiently passes for it. But it's no more like yours than the tortuous stone staircase—half-ruined into the bargain!—in some castle of our Quattrocento is like the 'lightening elevator' in one of Mr. Verver's fifteen-story buildings." And he is capable of exhibiting "a beautiful personal presence, that of a prince in all truth, a ruler, a warrior, patron, lighting up brave architecture."

Adam Verver, curiously sees the Prince in architectural terms: In the life of Maggie and her father, the young nobleman comes as a spectacular addition. "At first, certainly, their decent little old time union, Maggie's and his (Adam's) own, had resembled a good deal some pleasant public square, in the heart of an old city, into which a great Palladian church, say—something with a grand architectural front—had suddenly been dropped." . . . Later, two quite striking architectural images are used to describe Maggie's consciousness of the collusion of the two faithless spouses. The first is "it now arched over the Princess's head like a vault of bold span that important communication between them on the subject couldn't have failed of being immediate." The second is similar: "They had built her in with their purpose—which was why, above her, a vault seemed more heavily to arch; so that she sat there, in the solid chamber of her helplessness, as in a bath of benevolence artfully prepared for her."

Henry James' story of the Ververs, the Prince and Charlotte is an extremely sophisticated dramatization of the hard fact that an enduring structure cannot be built on a faulty foundation. Architectural metaphors are peculiarly appropriate for this, the most mannered of James' novels, and they play an important part in the over-all composition of the book. From the beginning when we are told of the Prince's family palaces, through the descriptions of elegant town houses, vast country places, balustrades, and terraces, we see setting blended with action.

The illicit love of Charlotte and the Prince is suitably surrounded by splendid rooms and ornate balconies; glamour becomes these two.

The Princess's suffering, and her victory, the daring of the guilty lovers, and their defeat, are well expressed in terms of terraces, distant towers, pagodas hung with silver bells—and, finally, by "high cool rooms," with long windows open to the impassive day.

Architecture, so Frank Lloyd Wright tells us, is "man in possession of his earth." It fitly ornaments this story of how innocence comes into its own.

AWARDS

Serge Chermayeff, Professor Emeritus, Yale University, was awarded the Gold Medal of the Royal Architectural Institute of Canada. . . . Jean Labatut, former professor of architecture at Princeton University, received the Thomas Jefferson Memorial Foundation Medal In Architecture, awarded annually by the organization that oversees Thomas Jefferson's Monticello estate. The medal recognizes persons who have distinguished themselves in architecture. . . . Hannes Westerman, a West German architect, won the 1973 R.S. Reynolds Memorial Architectural Award for his design of the Norddeutsche Landesbank in Braunschweig. . . . A. Barry Morris of the consulting engineering firm of Hurst and Adams in Falls Church, Va., is Draftsman of the Year. It is the fourth time Mr. Morris has won the award given by the Consulting Engineers Council of Metropolitan Washington. . . . Craig D. Roney of Andover, Mass. is the recipient of the 1973 Rotch Travelling Scholarship.

CONFABS

"EH . . . WHAT, BRUTUS?"

Since the days of Julius Caesar, man has been increasingly irritated by the earsplitting problem of noise. The great Caesar had chariots banned from the cobblestone streets of Rome to alleviate the nerve-wracking situation. Bolt, Beranek and Newman Inc., however (realizing today's noisemakers are not so easily vanquished), are actively seeking solutions.

Two seminars on noise and vibration control are being offered under the direction of Laymon Miller, whose forte over the past 30 years has been researching the treatment of the noise abatement concern. These courses evolve in two separate workshops: "Noise Vibration and Control in Buildings" (Offered in Chicago, September 5-7; New York, September 19-21; Memphis, October 17-19, and Miami, October 31-November 2) and "Noise in Manufacturing Plants" (Chicago, September 10-12; New York, September 24-26; Memphis, October 23-25; and Miami, November 5-7).

To receive registration information, write to Ms. Gloria Cianci, Bolt Beranek and Newman, Inc., 50 Moulton Street, Cambridge, Massachusetts 02138.

GROWTH

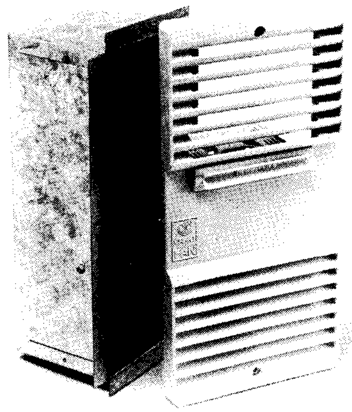
• For the first time, a conference aimed at striking a balance between ecological and conservation interests and continued economic growth will be held in Tulsa, Oklahoma, September 23-26. Jointly sponsored by the Metropolitan Tulsa Chamber of Commerce and the Midcontinent Environmental Center Association (MECA) with the Chamber of Commerce of the United States as a co-operating sponsor, "Growth with Environmental Quality?" will bring together leaders of differing points of view in all environmental areas to question the balance between economics and ecology and try to determine where it lies. This forum, according to general chairman Joseph H. Williams, president of the Williams Companies will be the first to encompass discussion on all issues—land use, energy, technology, people, and the quality of life. A segment of the forum will also examine the international aspects of environmental issues.

Information concerning the forum can be directed to Public Relations Manager, Bruce Carnett of the Metropolitan Tulsa Chamber of Commerce, 616 South Boston Avenue, Tulsa, Oklahoma 74119.

PHOTOGRAPHS: page 22 and 23 (top) William Douglas Gansen; 23 (bottom) Cornell University; 25 (bottom) New York Times; 27 Leonardo Le Grand, Museum of Modern Art; 30 (top) The Christian Science Monitor; 32 (top) Nathaniel Lieberman; 98 (top) The Bettmann Archive, (center) Educational Facilities Laboratories.

PRODUCTS

DUCTLESS



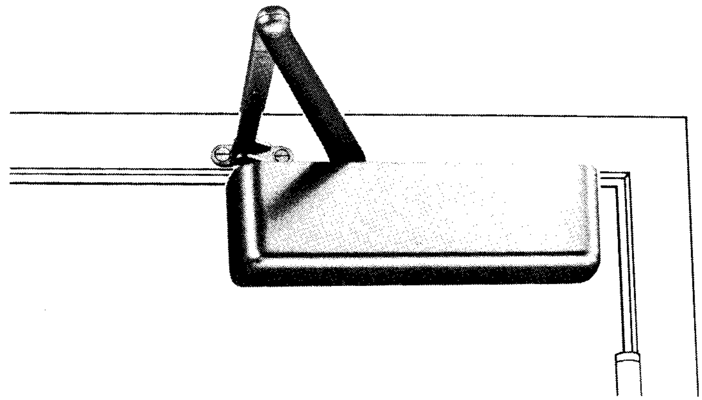
Rush-Hampton Industries has introduced the CA/90 ductless bathroom fan unit. CA/90 is a new chemical that retards growth of odor and disease causing bacteria and fungi. A small chemical ejector cartridge is located in the unit and an electric dispersal fan in the unit pulls air into it and through the ejector cartridge. Polluted air is cleansed as it passes over the chemical; as the treated air is diffused in the room, it retards growth of bacteria through air circulation. Besides the cost savings inherent in a ductless unit, there is the safety factor wherein smoke and fire cannot travel through extensive ductwork. The only portion of the unit which is visible on installation is a decorative diffuser, which may be coordinated with decor. The CA/90 unit is endorsed by HUD, especially in cases where sanitation requirements are strict.

On Reader Service Card, circle 100.

QUIET ZONE

"Grand Central" is the latest addition to Armstrong Cork Company's Quiet Zone line of cushioned vinyl flooring. The floors have a virtually nonporous wear layer of vinyl, providing stain resistance and needing minimum maintenance. An interlayer containing fiber glass filaments adds stability and protection against impact damage. The backing is a 1/8" layer of vinyl foam. Cushioning offers sound conditioning benefits as well as allowing mobile units to roll easily over the surface. Flooring is recommended for installation over concrete and terrazzo at all grade levels, as well as suspended subfloors of plywood, double-strip wood, hardwood or metal. It can be installed directly over old resilient flooring which is securely bonded to the subfloor. "Grand Central" comes in white, beige, gray/beige, brown, gold and green.

On Reader Service Card, circle 101.

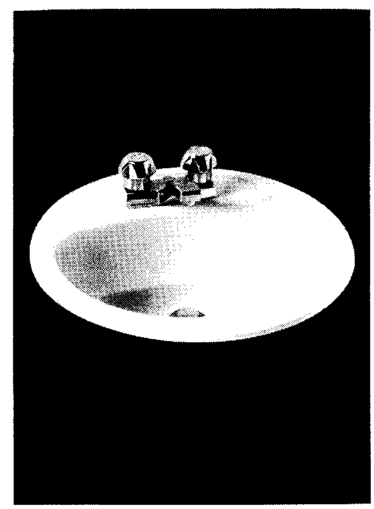


SUPER-SMOOTHEE

Yes, really, LCN Closers has introduced "Super-Smoothee", a heavy duty, non-handed, non-sized door closer that can be mounted four ways. The closer has adjustable spring power which accommodates exterior doors 2' through 4', and interior doors 2' through 5'. The unit can be mounted on the hinge face of a door, over the door, on the stop face, or on a bracket. One template location for each different mounting allows all available degrees of opening. In addition, there is an adjustable hydraulic back-check with a special valve that provides cushioning of opening swing prior to 90 degrees on all applications.

On Reader Service Card, circle 102.

CLEAN



A 19" round steel lavatory, called "Bayside", has been announced by the Eljer Plumbingware Division of the Wallace-Murray Corp. This uni-rim round countertop sink is made of acid resisting enameled formed steel. It has a front overflow, two soap depressions and a fitting ledge. A clean-edged neat appearance is the result of no metal rim around the frame of the sink. The illustration shows Eljer's "Ultima" centerset fitting with aerator, pop-up waste. It comes in white and six decorator colors.

On Reader Service Card, circle 103.

MINI-WEAVE

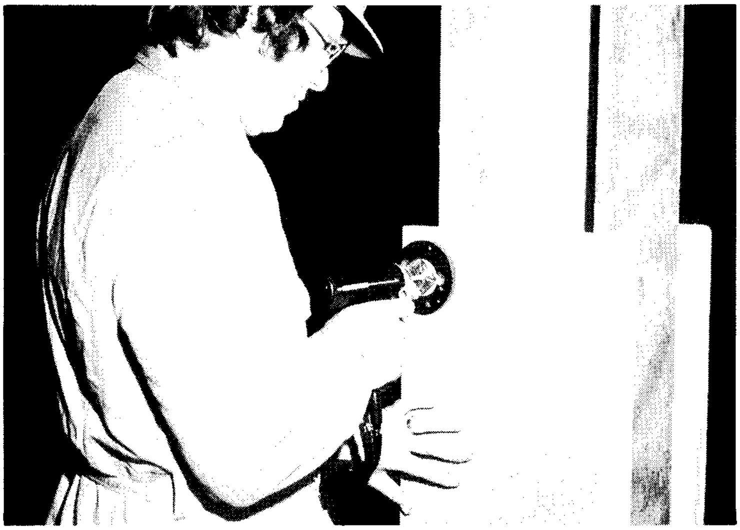
From Exxon Chemical Company U. S. A. comes "Mini-Weave", a three-dimensional reproduction of tightly woven cane designed for residential and contract furniture, casegoods, cabinets, fixtures, doors and wall panels. It is being offered in sheet sizes of 3' x 10', 4' x 8', and 4' x 10'. There is a high-pressure plastic laminate finish which makes the covering practical. A look and feel of real cane is achieved by the combination of a raised textural surface, which adds depth and shadow to the pattern, and a natural coloration.

On Reader Service Card, circle 104.

(Continued on page 102)

PRODUCTS

(Continued from page 101)



STRUCTO-GARD SYSTEM

A new system to fireproof structural steel which replaces sprayed fireproofing, has been developed by Johns-Manville Corp. and implemented jointly by J-M and Tishman Realty & Construction Co., Inc. The system, called "Structo-gard", consists of mineral fiber board which is applied to steel beams and columns, utilizing a stud welding gun which fixes the material to the structural member with a steel stud and friction washer. According to the developers, the system meets Underwriters' Laboratories requirements. Since a prefabricated board of standard dimension is used, control standards are relatively easy to maintain. This should eliminate thin spots and assure maximum fire protection over the entire structural framework. Because the system is not sprayed-on, application is easy to control in all weather conditions. The developers say that this new system does not pose any of the environmental or health hazards common to asbestos or spray-on fireproofing materials because there is the elimination of the dispersion of pollutants.

On Reader Service Card, circle 105.

SOLARCOOL

Two new architectural glasses, called "Solarcool Bronze" and "Solarcool Gray", have been added to PPG Industries' line of Solarcool glass products. They are reflective float glasses having a reflective film applied to tinted glass. The coating is said to reduce heat buildup and subdue indoor brightness. Solar energy reduction can lower air-conditioning loads and costs as well as aid energy conservation. The metallic coating permits use of the product in single glazing since it resists weathering without the need for protection in the air space of a double-glazed unit. The glasses are annealed and can be cut or fabricated in the same way as ordinary float or sheet glass. Solarcool products may also be tempered or

heat-strengthened for places requiring greater thermal and wind load resistance.

On Reader Service Card, circle 106.

(Continued on page 104)

On Reader Service Card, Circle 321→

PRODUCTS

(Continued from page 102)

5′ x 5′

A 5′ x 5′ lighting-ceiling system which incorporates acoustics and air distribution has been introduced by the Interior Products & Systems Division of Keene Corp. Designated "Spec 100", the system consists of a 20″ x 20″ lighting fixture, with crossed 40-watt fluorescent U-lamps; 20″ x 20″ acoustical tiles that slide out for maintenance purposes; provisions for electrical wiring that can come down through the grid system without damage; and air distribution through individual air boots or a continuous linear plenum. The system can be designed for custom application to individual projects, with an illumination capability from 70 to 100 foot candles. A variety of lenses are available for low brightness or special effects. Acoustical tiles are available with different surface textures.

On Reader Service Card, circle 107.

MOTIFS

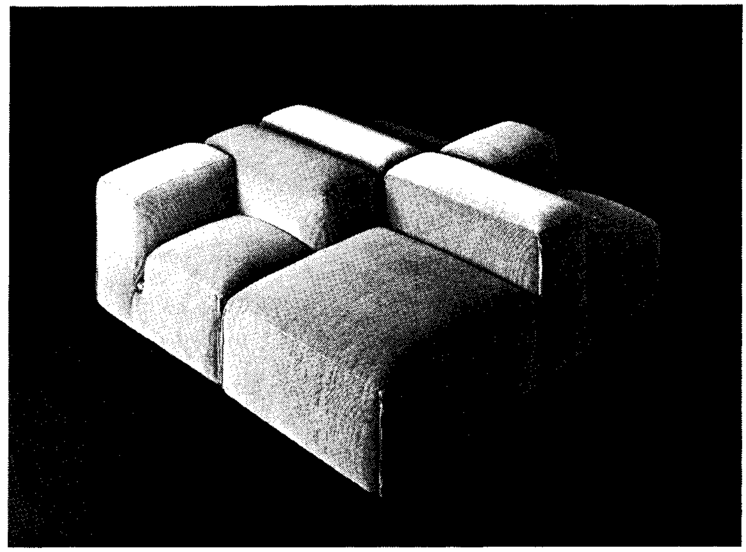
Giacometti-like silhouettes highlight "People," a new wall hanging that can also serve as a rug, available from Concepts International's *Elevations* collection.

Screen-printing, a multi-dimensional, layered color effect, is attained on this particular pattern that could not be produced with a woven pattern. "People" is a blend of 80 percent wool and is available in natural with brown color.

Among other wall hanging/rug patterns featured in the *Elevations* collection are geometric motifs and whimsical figures produced with the same screen-printed technique. Aimed particularly at the informal consumer, the Elevations collection comes in various conventional sizes and also several extra

small sizes (2′ x 3′ and 3′ x 4′). Nine patterns are available, each in a selection of colors.

On Reader Service Card, circle 108.



LE MURA

Italian architect Mario Bellini has designed the "Le Mura" collection for Atelier International, Ltd. The collection is manufactured by Cassina Milan in Italy, and consists of an armless chair, a chair with left or right arm, a two armed chair, an ottoman, and a single or double bed. The units are constructed with a foam polyurethane body on a wooden base with dacron fiberfil cushioning and may be upholstered in fabric, vinyl, or leather. The units interchange to provide a variety of seating/lounging configurations; "buckle" fittings affixed to each piece secure the units together. Most components are scaled at a 36″ width, although the two-arm chair measures 50″ and is adaptable to public and large scale residential spaces.

On Reader Service Card, circle 109.

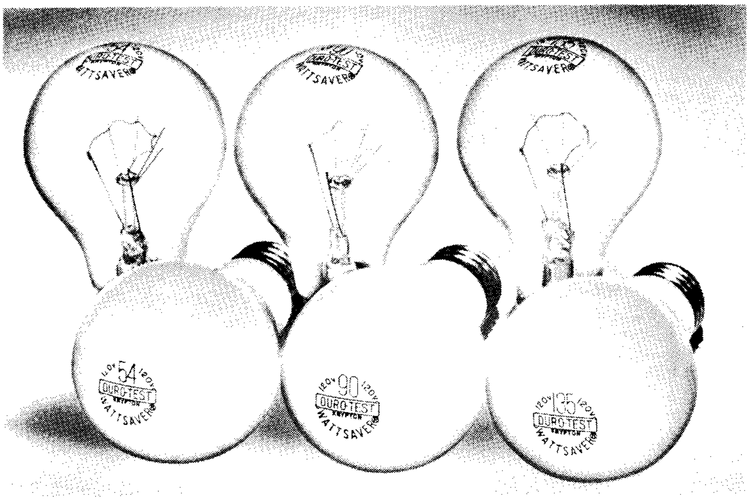
DOUBLE-DUTY

PPG Industries has announced a new gas-filled insulating glass unit for windows having greater insulating efficiency than ordinary air-filled units. Twindow X[i] insulating glass minimizes condensation on room-side glass surfaces to permit higher, more healthful indoor humidities.

In the manufacturing process, two pieces of sheet glass are permanently fused together along the edges in a process similar to arc welding. The unit then moves to a vacuum chamber where it is filled with the special dry nontoxic gas and then is sealed.

Twindow X[i] reduces conducted heat loss about 45 percent better than a single pane of clear glass and about 20 percent better than a conventional air-filled double-glazed unit, according to Robert M. Hainsfurther, vice president and general manager of the glass division.

On Reader Service Card, circle 110.

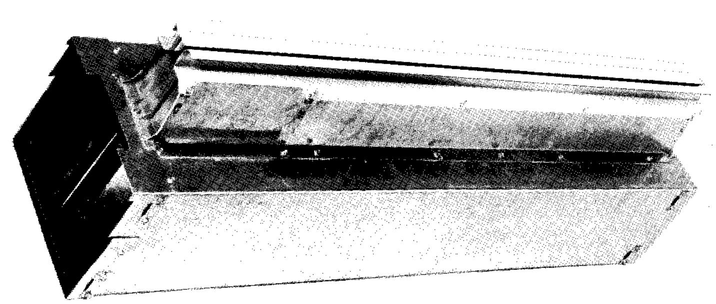


WATT CONSCIOUS

A line of new premium-life light bulbs that consumes up to ten percent less watts of electrical energy and still provides the same amount of light as conventional-wattage bulbs of the same life, has been announced by the Duro-Test Corporation. Krypton gas is used in the bulb and the patented "copperflex" filament that was developed by Duro-Test. This gas retards the evaporation of the filament, allowing it to burn brighter for a longer period of time. This results from the low heat conductivity and high atomic weight of krypton, which exists in the atmosphere at a ratio of one part per million. Argon, the gas used in conventional bulbs, exists at a ratio of one part per hundred. The "copperflex" filament process contributes both to the durability and brightness of the new bulbs. The process provides a filament whose metal is purer, more uniform, more resilient and up to ten times stronger than conventional filaments, reports Duro-Test.

A bonus benefit of reduced wattage bulbs, in addition to conserving electrical energy, is that of a simultaneous savings in the user's lighting bills. Duro-Test reportedly can save the homeowner $27.00 over the 2,500 hour life of the bulb, at a rate of 3¢ per kilowatt hour. The properties of krypton-filled lamps were studied thoroughly in a paper by Dr. Wolfgang Thouret (who headed the watt saver development) which was published in 1970 and entitled "Transaction of the Illuminating Engineering Society."

On Reader Service Card, circle 111.



HOT & COLD

Carrier Air Conditioning Company has developed a modular ceiling-mounted air terminal for variable volume systems called the "37 AD". It is designed to provide cooling and heating simultaneously, and is primarily to be used as a ceiling installation near the building's periphery. Since it eliminates the need for a separate heating system, it reduces costs and uses less space. The heating side of the system sweeps periphery walls and windows while the cooling side serves the interior zone. An insulated sheet metal divider separates cold and warm air streams. The system can be adapted for cooling only.

On Reader Service Card, circle 112.

On Reader Service Card, Circle 322→

PRODUCT LITERATURE

To order any of the literature described, circle the indicated number on the self-addressed Reader Service Card on page 107.

Water Coolers, Fountains
1973 condensed catalog, MPC-73, featuring photographs and complete descriptions of Sunroc water coolers, Western drinking fountains, emergency safety showers and eyewashes. Available from Sunroc Corp. and Western Drinking Fountains. From Sunroc: High back wall hung, semi-recessed, and compact fountains; also, compact wall hung water cooler. From Western: Vitreous china, stainless steel, and 3-pedestal fountains. On Reader Service Card, circle 200.

Mosaic Tile
Color brochure illustrating American Olean's line of glazed, quarry, and ceramic mosaic tile. Featured are both the silicone rubber factory-grouted Redi-Set ceramic tile system and the Redi-Set 200, ceramic mosaic sheets with polyurethane grout. Describes color co-ordination, architectural specifications, and commercial applications. On Reader Service Card, circle 201.

Roofing Systems
Full color 4-page brochure demonstrates use of patented Kalwall Translucent Panel system as "skylites" and "skyroofs." Outlines applications; provides technical data, detail drawings, and short form specifications. Kalwall consists of two fiberglass reinforced face sheets permanently bonded to a structural aluminum I-beam grid core. "Sandwich" panel said to be shatterproof with insulation options. On Reader Service Card, circle 202.

Concrete Poles
Brochure on architectural and area lighting poles offered by Centrecon, Inc. Publication describes octagonal and round poles of spun pre-stressed hollow concrete in lengths from 13 to 49 feet. Poles available in plain or colored concrete, or in polished terazzo finishes. On Reader Service Card, circle 203.

Insulating Concrete
Comprehensive booklet detailing lightweight perlite insulating concrete for roofdeck applications available from Perlite Institute, Inc. Contains density selection guide and physical properties; describes use over steel form units, structural or precast concrete roof slabs, and form boards. Also includes detail drawings, fire ratings, and design data. On Reader Service Card, circle 204.

Plywood Walls
32-page publication contains detailed sketches on uses of trim and millwork in producing walls free of visible joints. Entitled "Architectural Plywood Walls," brochure available from the American Plywood Association. Said to be useful as an immediate design problem solver or as a stimulant of new approaches to wall construction. Design concepts for application to wide variety of single and two-story structures. On Reader Service Card, circle 205.

Brass Lavatory Fixtures
Artistic Brass, a division of Norris Industries, has introduced a new "Tomorrow Line" of decorative bathroom fixtures and accessories. Line presently composed of 4 basic de signs— Pisces, Aquarius, Aries, and Libra. Each available in lavatory and tub sets; matching accessories included. On Reader Service Card, circle 206.

Lead Designs, Applications
From Lead Industries Association, Inc., an 8-page booklet entitled: "Lead . . . As A Modern Design Material." Discusses properties, forms, and design applications of lead. Revised and updated version of similar 1963 booklet. Applications such as corrosion, vibration, sound control, radiation resistance, soldering, ceramics, and forms available listed. On Reader Service Card, circle 207.

Illumination Systems
Available from Siltron Illumination, Inc.: New catalog illustrating complete product line, including AC and DC power packs, Remote Emergency fluorescent power packs, Emergency Luminaires, Emergency Lighting Consoles, and Unit Packs for retro-fitting existing fluorescent fixtures. Specifications, dimensional data drawings included. Application and technical bulletins part of package. On Reader Service Card, circle 208.

Cubicle Hardware
Descriptive material on line of Grant Hardware cubicle tracks, curtains, and intravenous feeding systems. Data on mono and duo-rail intravenous support systems, cross sectional views, and mounting data and detailed specifications. Also summarizes in-ceiling, to-ceiling, and dropped - from - ceiling cubicle track mountings; surface and recessed tracks described. On Reader Service Card, circle 209.

Refrigerated Prefabs
Description of refrigerated buildings from Bally Case & Cooler, Inc. Brochure summarizes design, manufacturing, and assembly features of Bally panels. Panels constructed of 4-inch urethane foamed-in-place between two sheets of aluminum, galvanized or stainless steel. Bally refrigeration systems also summarized. On Reader Service Card, circle 210.

Plastic Extrusions
Two-page guide on the systems approach to the fabrication of plastic profile extrusions published by Crane Plastics. Covers systems approach, lowest per-piece fabrication costs, and various standard fabrication operations available. Also: description of automated, in-line operations. On Reader Service Card, circle 211.

Solid Waste Disposal
Brochure describes Combustopak incinerator, a compact, modular, solid waste disposal unit manufactured by Combustion Engineering, Inc. Incinerator designed to serve needs of municipalities and industrial operations. Combines disposal with haulage and landfill savings. Meets stringent pollution control standards. On Reader Service Card, circle 212.

Load Factor Design
Technical paper entitled "Load Factor Design of Steel Buildings" published for structural engineers. Written by T.V. Galambos, Chairman, Department of Civil and Environmental Engineering, Washington University, St. Louis. Paper based on research sponsored by American Iron and Steel Institute. Describes trend toward probalistic structural design, in which uncertainties (loading, design assumptions, etc.) are treated in a statistical instead of intuitive manner. On Reader Service Card, circle 213.

Emergency Lighting
Brochure outlines use of battery-powered inverter system to allow existing fluorescent lighting to be used as battery-powered emergency lighting. Published by the Exide Power Systems Division of ESB, Incorporated. Exide system employs a small inverter to change DC battery power to AC power compatible with the fluorescent lamp's operation. On Reader Service Card, circle 214.

Sliding Doors
Folder of continuous ball bearing hangers to support heavier-than-average interior and exterior communicating doors, partitions, and sliding glass doors. Available from Grant Hardware Co. Photographs of applications, sectional view drawings, load ratings, minimum tolerances, related data. Indoor/outdoor. Doors up to 35 lbs., heavy doors, partitions, and walls up to 300 lbs. On Reader Service Card, circle 215.

Surgical Lighting
14-page color catalog, covering a broad range of surgical lighting systems, available from American Sterilizer Co. Illustrated with detailed photos. Focuses attention on 8 new surgical systems, including dual, single-source, rotating, dual track, modular and Centra lighting system. Accessories described. On Reader Service Card, circle 216.

Suspension Ceilings
Up-dated literature on suspension ceiling systems and demountable wall systems available from Eastern Products Corp. Fully illustrated with detailed specifications; information catalogued or separable for easy reference. On Reader Service Card, circle 217.

Kitchen/Laundry Ideas
24-page "idea stimulator" designed for modern single- and multi-family living from General Electric. 25 illustrated kitchen and laundry concepts. Scaled floor plans for complete kitchens and laundry rooms. On Reader Service Card, circle 218.

Indoor Luminaires
Data sheet from Holophane Co. describes two Prismpack II 1000W mercury indoor luminaires. Designed for wide variety of high-bay industrial, sports arena, and coliseum applications. Provides info on photometrics, dimensions, electrical characteristics, decorative and functional accessories. On Reader Service Card, circle 219.

Panel Systems
Bulletin featuring Varispan Panel Systems from Elwin G. Smith Division, Cyclops Corp. Varispan is a new metal wall system offering greater strength, longer spanning ability and versatility. Maximum spanning distance between girts depends on metal, gauge, and liner panel depth. Gives dimensions, technical data, load span tables, and architectural specifications. On Reader Service Card, circle 220.

Drafting Film
Six-page brochure, "What Drafting Film of DuPont 'Mylar' Can Do For You," available from the DuPont Co. Demonstrates how drafting systems based on Mylar film can be tailored to meet problems of time, budget, or quality. Film compared with other media in drawing production. Reproduction benefits explained. Drawing preservation outlined. On Reader Service Card, circle 221.

Concrete Consistency
Six-step procedure for conducting a standard concrete slump test depicted in placard available from Master Builders. Slump test conforms to requirements of the American Society for Testing and Materials. Determining slump of new concrete, checking bath-to-batch uniformity detailed. On Reader Service Card, circle 222.

Plywood Siding
Latest product data sheets from the American Plywood Association. Easy-reference formats, specifications and technical facts, uses of plywood siding, and code acceptance data included. On Reader Service Card, circle 223.

Gutters, Coping
1973 catalog from W.P. Hickman Co. Coverage given to new Permasnap Coping and the 100 Series Fascia. Permasnap is a gutter/chair system consisting of 3 pieces—a perforated cleat, a molded styrene chair, and heavy gauge coping. A special adhesive bonds the cleat to the parapet, eliminating imbedded anchor bolts. Enables system to withstand wind uplift of 60 lbs. On Reader Service Card, circle 224.

(Continued on page 110)

PRODUCT LITERATURE

(*continued from page* 10)

LIGHTING FIXTURES
From the Sechrist Lighting Division of the Keene Corporation 7 examples of Sechrist line of contemporary light fixtures are covered in an 8-page brochure including Regressed Air-Lite Troffers, 6-inch wide Troffers, surface luminaires, Gym-lite, ceiling or wall-mounted fixtures, and completely sealed exit fixtures. On Reader Service Card, circle 225.

BUILDING SEALANTS
Dow Corning offers 8-page brochure outlining application information on four types of silicone building sealants, along with a 20-year material guarantee against color change, hardening, or cracking from weathering. On Reader Service Card, circle 226.

FRAMING SOFTWOOD
Expanded to include additional design values and complete data on lumber sizes and grades, 1973 edition of the Western Wood Technical Library "Product Use Manual" now available from Western Wood Products Assoc. A basic technical guide for selecting light framing lumber and estimating needed quantities of siding and paneling, manual includes tables on design values for light framing and on properties of sections for joists, beams, planks, decking. Other catalogs available. On Reader Service Card, circle 227.

TEXTURED LIMESTONE PANELS
January, 1973 "Textured Panels of Indiana Limestone," published by Harding & Cogswell, Inc., introduces several newly created texture finishes and includes photos of actual jobsite erection of the large textured panels; also includes square foot price information for the floor-to-floor panels, typical anchoring details, and short form specifications. On Reader Service Card, circle 228.

POWDER COATINGS
A technical/descriptive bulletin about Vitralon powder coatings has been issued by Pratt & Lambert. 22 advantages of powder coatings are presented and performance characteristics listed. Also provided are technical data on surface preparation, application, curing methods, storage, service, and specifics on chemical resistance, hardness, and adhesion. On Reader Service Card, circle 229.

SILICONE SEALANTS
New literature from General Electric describes service of silicone sealants possessing an inherent resistance to heat, cold, ozone, sunlight, radiation, and moisture. Specifics on GE silicone sealants 1200, 1300, and 1600 charted. On Reader Service Card, circle 230.

SPRINKLERS
Handbook on sprinkler systems covering what they do and how they work published by Honeywell's Commercial Division. Called "the most comprehensive guide to sprinklers ever written." Discusses wet and dry pipes, pre-action sprinklers with and without supervised piping, deluge types, and other common systems. Also, drawings of basic system types. On Reader Service Card, circle 231.

CARPET INSTALLATION
Architectural guide specification for glue-down installation of double jute-backed carpets, already in 15th printing, available from Jute Carpet Backing Council. Gives detailed installation instructions; explains why jute's porosity and affinity to standard adhesives allow no-pad glue-down installation. On Reader Service Card, circle 232.

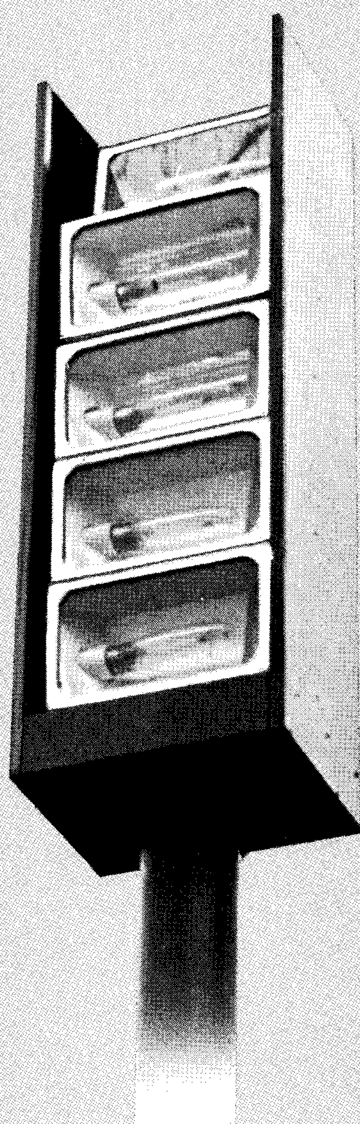
WOOD ADHESIVES
Four-page illustrated catalog describing Scotch-Grip Adhesive 5230, Scotch-Grip Construction Mastic 4314, and Scotch-Weld Polymer Bond Structural Wood Adhesive system for wood bonding applications for either in-plant modular house assembly or job site construction available from 3M Company, Adhesives, Coatings, and Sealers Division. Describes and illustrates how high strength, weather resistant adhesives can reduce construction costs. On Reader Service Card, circle 233.

JOINT COMPOUNDS
"Architects' Guide to Joint Treatment," an 8-page brochure from United States Gypsum Co., provides data for use in selecting and specifying gypsum drywall joint finishing systems, describing features of various kinds of joint treatment compounds, their compatibility, and the merits of hand and machine application. Joint system selector and job inspection procedures included. On On Reader Service Card, circle 234.

TENNIS ELASTATURF
Brochure from Borden Chemical describes the "superior playing qualities" of their Elastaturf synthetic tennis court surfacing material, emphasizing wearability, resiliency, and controlled surface texture. Traction of the poured-in-place material outlined; absence of seams and curled-up corners aids safety. Material customized to courts in three basic colors—grass green, clay red, earth tan. On Reader Service Card, circle 235.

ENTRANCE SYSTEMS
Brochure from Kawneer/AMAX describes the Entara-XD Educational Entrance system designed for strength and security in schools and colleges. Shows heavy duty aluminum structural frame components; features include door corners joined with machine bolts with welded shear blocks, attachment of high-stress hardware directly to ¼-inch thick aluminum extrusion walls, interlocking frames, double weatherstripping, and a pressure equalized threshold. On Reader Service Card, circle 236.

On Reader Service Card, Circle 328



Five Infranor Series 30 Wall Liters are stacked vertically in this decorative painted housing. Housings are mounted atop 12' poles set back 17' to 110'.

ADVERTISING INDEX

ABSTRACTA STRUCTURES, INC. William McDade Advertising Agency 109

AMERICAN IRON & STEEL INSTITUTE Coordinated Communications, Inc. 34-35

ARGO & COMPANY, INC. E.L. Sanders & Associates 109

BURNS & RUSSELL COMPANY, The Marc Smith Company 109

DURO-TEST CORPORATION Katz, Jacobs & Douglas,* Inc. 5

FOLLANSBEE STEEL CORPORATION George Hill Company 21

GOLD MEDAL FOLDING FURNITURE COMPANY Franklin/Mautner Advertising 99

GRACE & COMPANY, W.R. Fuller & Smith & Ross Inc. 33

INFRANOR, DIV. OF STERNER LIGHTING, INC. Selwyn/Conway Advertising Inc. 112

INLAND-RYERSON CONSTRUCTION PRODUCTS COMPANY Hoffman-York, Inc. .... IBC, 16-17

JOFCO John Brown Advertising Agency 9

JOHNS-MANVILLE, RESIDENTIAL DIVISION Broyles, Allebough & Davis, Inc. 18-19

JOY MANUFACTURING COMPANY Covey & Koons, Inc. 26

KAWNEER ARCHITECTURAL PRODUCTS Garrison, Jasper, Rose & Company 6-7

LCN CLOSERS Alex T. Franz, Inc. 102-103

LEVOLOR LORENTZEN INC. Muller Jordan Herrick Inc. 106w-2, 106w-3

LIBBEY-OWENS-FORD COMPANY Campbell-Ewald Company 12-13

MARLITE DIVISION OF MASONITE CORPORATION Howard Swink Advertising .... BC

MODERN MASTER TAPESTRIES Jamian Advertising & Publicity, Inc. 110

MYRTLE DESK COMPANY Haymes & Carr, Inc. 105

NEOGARD CORP., THE, a subsidiary of Jones-Blair Co. Tracy-Locke Advertising & Public Relations, Inc. 111

OWENS-CORNING FIBERGLAS Ogilvy & Mather Inc. 28-29

PPG INDUSTRIES Ketchum, MacLeod & Grove Inc. 2-3

PLASTIC-VIEW TRANSPARENT SHADES Associated Advertising Arts 109

PRAEGER PUBLISHERS, INC. Waterman, Getz, Niedelman Advertising 111

RICHARDS-WILCOX MANUFACTURING COMPANY Hanson Advertising Inc. 99

RUSH-HAMPTON INDUSTRIES Luckie & Forney Inc. 11

SAFE-T-BATH, INC. 111

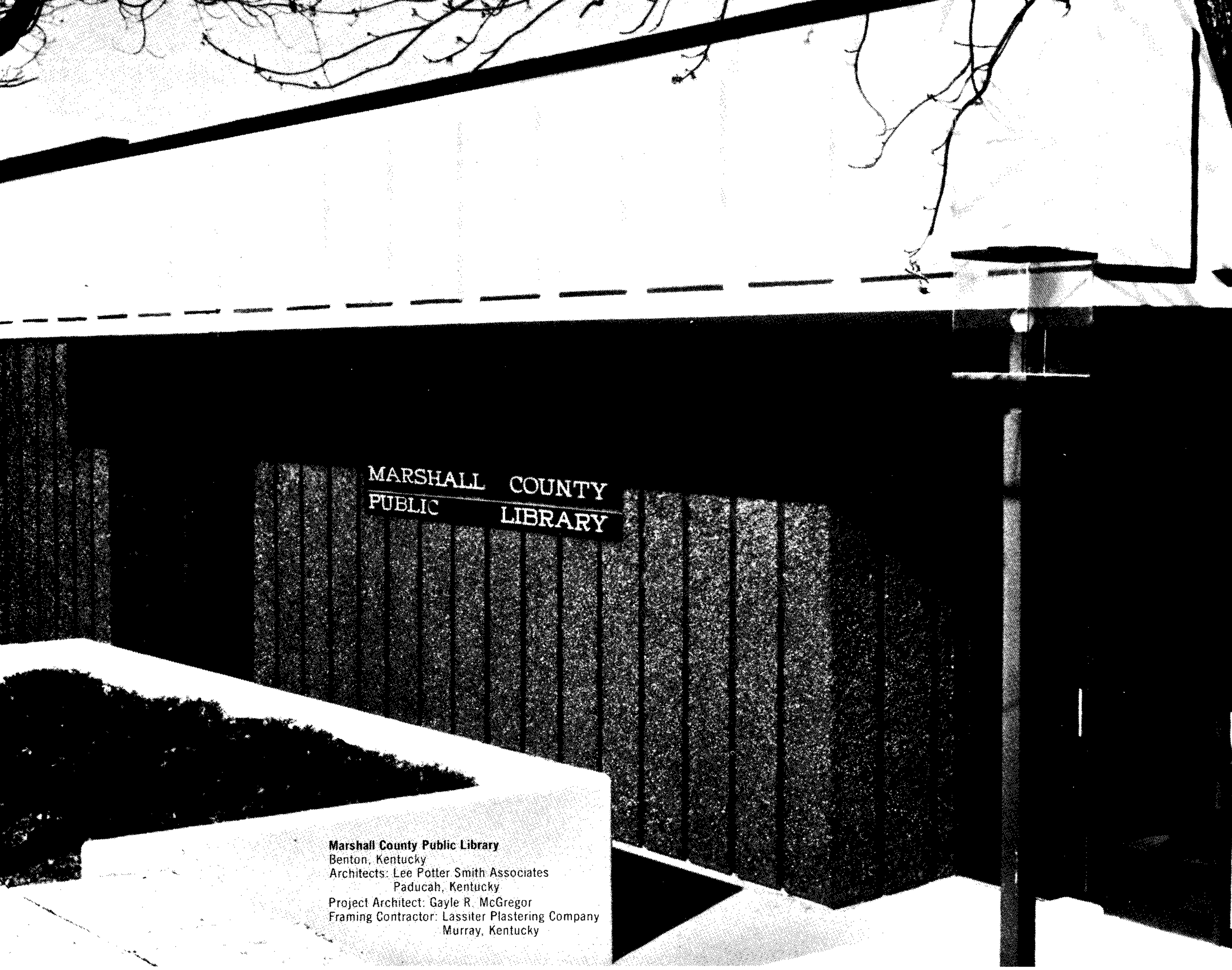
SILBRICO CORPORATION Elving Johnson Advertising, Inc. 24

SOUTHERN CALIFORNIA GAS COMPANY Doyle Dane Bernbach, Inc. 106w-1

SOUTHERN COMPANY, THE Liller Neal Battle & Lindsey, Inc. 31

THONET INDUSTRIES, INC. APCL&K Inc. .... IFC

←On Reader Service Card, Circle 332



Marshall County Public Library
Benton, Kentucky
Architects: Lee Potter Smith Associates
Paducah, Kentucky
Project Architect: Gayle R. McGregor
Framing Contractor: Lassiter Plastering Company
Murray, Kentucky

Four good reasons for considering Inryco™/Milcor® light gage steel framing when designing small buildings.

Design freedom, versatility, fast enclosure and economy . . . the benefits that make light gage steel framing so popular for the exterior walls of multi-story construction . . . can also be enjoyed on smaller buildings. Here are a few comments from project architect, Gayle McGregor, concerning the library pictured above:

"The variety of possible finishes available was an obvious advantage."

"Site conditions complicated the footings and foundation design. Light gage framing enabled us to cut down on bearing weight."

"We were able to save about one square foot of floor space for every two lineal feet of wall . . . a value of about five thousand dollars on this small project."

"Prefabricating framing assemblies in the shop saved on-site time and helped us meet a tough winter construction schedule."

"We have gone on to six other projects using the same systems, including an elementary school that ran $15 per square foot compared to the $22 per square foot statewide average for this type of facility."

There are further advantages we haven't covered here. See Sweet's, section 5.3/In; send for catalog 37-1; or let a Milcor representative explain how they apply to one of your projects. Write to: Milcor Division, Inland-Ryerson Construction Products Co., Dept. G, 4031 W. Burnham St., Milwaukee, WI 53201.

INLAND RYERSON

General Offices: Melrose Park, Illinois
A member of the INLAND steel family

On Reader Service Card, Circle 302

7308

Another special place for Marlite Planks: where walls have to pass inspection.

From fast-food cafeteria to gourmet restaurant, there's one must for every eating establishment.

A spotless reputation.

That's why Marlite paneling is such a natural for the food-service area. Its wash-and-wear finish resists heat, moisture and grease. Comes clean with just a damp-cloth wiping. So Marlite stays fresh and spotless—even in the busiest places.

But Marlite doesn't look like your typical "heavy-traffic" wall. It comes in a handsome collection of textures, woodgrain reproductions, colors and designs. So you can find the bright idea you need to make any eating spot look special.

We've used two Marlite ideas in this cafeteria. Chapel Oak Design Planks—only 16" wide for fast installation. With contrasting Gold Lace Planks in the kitchen.

See what Marlite can do for your special places. Send for color literature and professional samples to Marlite Division of Masonite Corporation, Dept. 707, Dover, Ohio 44622.

For professional samples of Chapel Oak Design and Gold Lace, write Marlite, Dover, Ohio 44622.

Marlite®
We make walls for special places.

Marlite paneling is hardboard with man-made finish.

On Reader Service Card, Circle 303