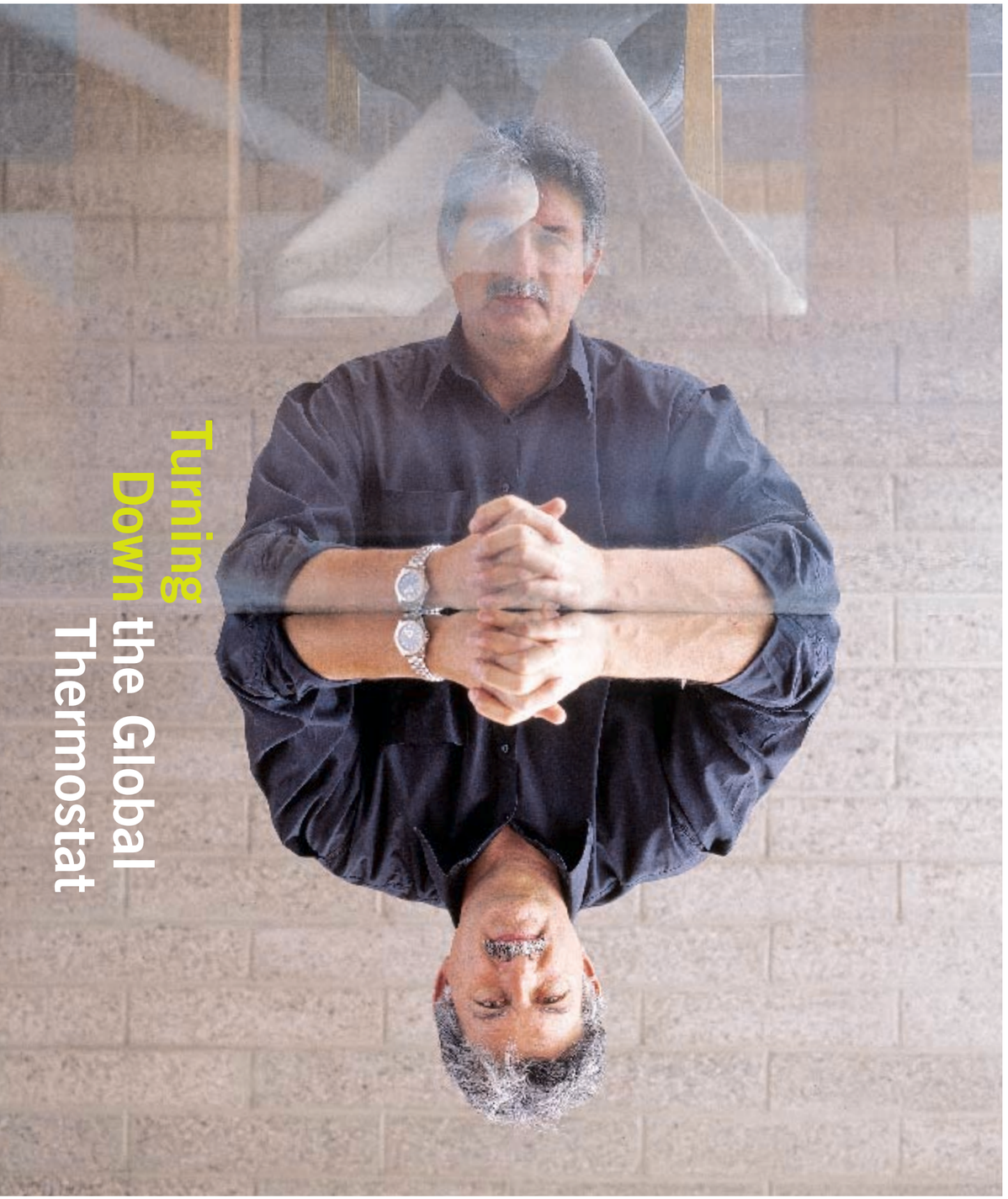
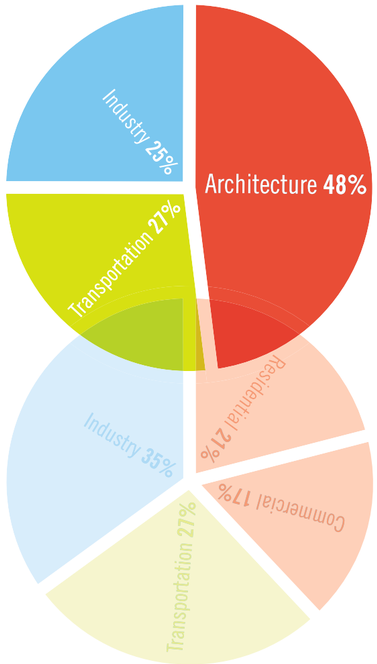


Turning Down the Global Thermostat

This page: Doug Hoeschler. Opposite page: data from Ed Mazria; graphics by Criswell Lappin.



U.S. Energy Consumption by Sector

A reorganization of existing data—combining the energy required to run residential, commercial, and industrial buildings along with the embodied energy of industry-produced materials like carpet, tile, and hardware—exposes architecture as the hidden polluter.

A veteran of green design has studied global warming and sees its cause—and possible solution—coming from the same unlikely source: architects.

By Christopher Hawthorne

It would be tough to argue with the suggestion that the sustainable-design movement has made significant, even dramatic, strides over the last decade. For architects, for industry, for the media, and for the general public, green design has moved from the fringe to the mainstream. We might not have reached the proverbial tipping point that would bring forth a massive shift in the way buildings are designed and built. But compared to, say, the automobile industry—which is actually regressing when it comes to energy efficiency, with average miles-per-gallon figures ballooning back to where they stood a generation ago—architecture looks downright progressive.

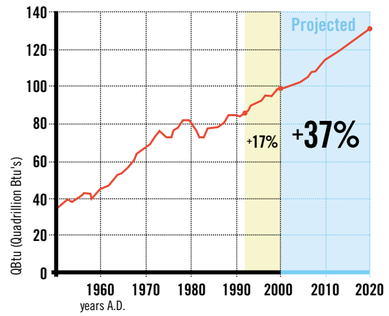
That's the conventional wisdom we comfort ourselves with, anyway. But in Santa Fe, New Mexico, an amiable six-foot-six-inch-tall, 62-year-old architect named Edward Mazria is engaged in what can only be called a personal crusade to convince the members of his own field that the conventional wisdom is dangerously out of touch with reality.

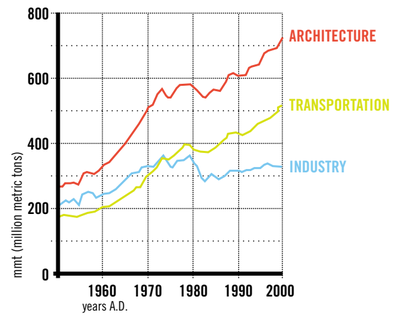
For Mazria the way the human race is changing the environment, specifically in terms of global warming, suggests nothing short of coming catastrophe. Already quantifiable results like melting ice caps, rising sea levels, and disappearing species, he says, should be enough to prove his case. Of course, environmental doomsdayers are a dime a dozen, but Mazria's sky-is-falling theory has a twist. He places both the blame and the responsibility for turning things around squarely on the shoulders of one profession: architects.

During the last year Mazria has studied the existing data and come to a startling conclusion: architects—together with the building industry—

Total U.S. Energy Consumption

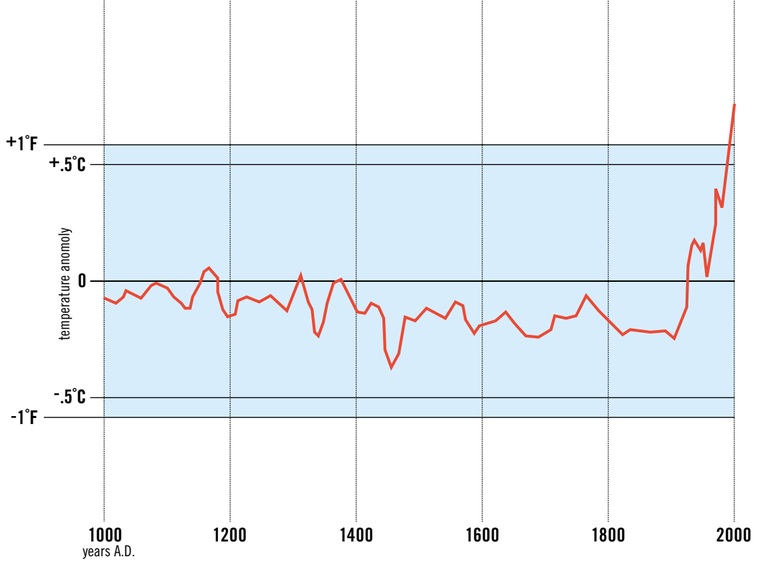
Despite the United Nations Framework Convention on Climate Change which promised to restore greenhouse gas concentrations in the atmosphere to 1990 levels, US energy consumption increased by 17% through the 90s. Experts predict an additional 37% rise in energy consumption by 2020.





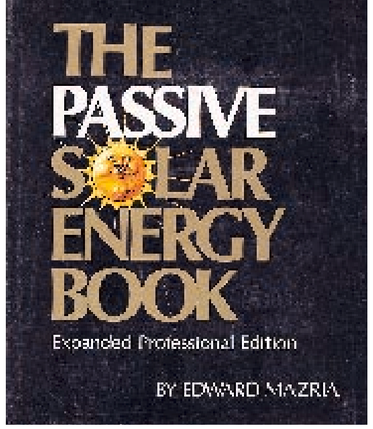
U.S. CO_2 Emissions by Sector

While levels of carbon dioxide emissions produced by industry remain steady, those produced by architecture are soaring, signaling a pressing need for widespread change in the way architects design buildings.



Global Temperature Variation

Since 1900 average worldwide temperatures increased more than an entire degree—a statistic that Mazria sees as a call to action for architects.



Mazria's 1979 book on the fundamentals of passive solar design has sold more than 500,000 copies worldwide.

This page: Temperature data from National Oceanic and Atmospheric Administration Paleoclimatology Program. Opposite page: photos courtesy Design Workshop Inc. Both pages: graphics by Criswell Lappin.

are responsible for just about half of America's energy consumption and half its greenhouse gas emissions, which are produced by burning coal, gasoline, and other fossil fuels. (Cars and trucks, by comparison, do roughly one-sixth as much damage.) Most scientists who've studied the issue will tell you that greenhouse gases trapped in the Earth's atmosphere lead to global warming—and that unchecked global warming is capable of causing everything from killer heat waves, withered crops, dying species, and melting ice caps to rising seas that would submerge most of the world's present-day coastline under water. Mazria has produced a traveling multimedia presentation and a sort of white paper entitled "It's the Architecture, Stupid!", parts of which were published earlier this year in *Solar Today* magazine, laying out his case in urgent, accessible prose.

Because Mazria is a member of the tribe he is now trying to shame into action (he's a principal in a successful architectural practice in Santa Fe, Mazria Riskin Odems Inc.) and an old veteran of the green design movement (he wrote the beloved *Passive Solar Energy Book* in the late 1970s, which has sold around 500,000 copies and has been translated into Spanish, French, Japanese, and Italian), people began to notice his newly intensified environmental activism fairly swiftly. But not swiftly enough for Mazria. "This is the most important moment in the history of architecture," he says. "I want to get this news to people as quickly as possible to establish the threshold between knowing and not knowing—a doorway from this world to an entirely new world in architecture. If architects don't attack this, then the world doesn't have a chance."

Energy Savings Buildings

Albuquerque, NM

Architects Mazria Riskin Odems designed the conservatory at the Rio Grande Botanical Garden (above) to run with little energy input. Minimized glazing on the west facade of the Peggy Ann Findlay Arts Center (below) protects the interior from the low summer sun.

The story of how Mazria came to this late-in-life conversion from mellow to rabid environmentalism began innocently enough. Every Friday afternoon at about 3 p.m. Mazria and the rest of the architects and staff in his office leave their desks and convene. "Somebody runs to get beer and chips, and we sit around a conference table and catch up on the week," Mazria says. "It's a social thing. A couple of people in the office even make their own beer, and sometimes they bring that in.

"One Friday last fall one of the younger architects said, 'You know, Ed, a lot of times you come over and give us a desk crit, and you tell us what to change or do to help make the building more sustainable, and usually it just works. But we want to understand *why*—why you suggest those particular choices, and what experience leads to them, and all that stuff you did in the 1970s and 80s.'"

The staff asked Mazria if he'd consider using Friday afternoons to lead them in a seminar in the particulars of green design. Mazria agreed, but realized he needed to give himself a refresher course. He had plans to take his four-year-old granddaughter to Disneyland that weekend, so he grabbed an extra bag and packed it with books. He hadn't picked some of them up for years.

"I wanted to start the seminar when I got back, and thought we would look at big picture first and then go down into the architectural nitty-gritty," Mazria recalls. "So I took the big-picture books with me." Many of these were books he'd added to his library in the 1970s while he was researching his famous 1979 book on solar energy. They included classics of environmental literature like *The Limits to Growth*, the text of a report by several noted experts first published in 1972.

Sitting in his hotel room, Mazria came across projections in the books he'd brought along about population growth, the amount of carbon dioxide in the Earth's atmosphere, and other threats to

"This is the most important moment in the history of architecture," Mazria says.

"If architects don't attack this problem, then the world doesn't have a chance."

MAZRIA'S EQUATION

Architect Ed Mazria has come up with a strategy to use architecture to attack the problem of global warming. He looks at the five billion square feet of building space that goes up each year in this country, along with the additional five billion square feet of renovation, as a place where remarkable energy savings could be achieved. His concrete proposals are as follows:

-15%

Incorporate information regarding the embodied energy in building materials into a federally sponsored, nationwide, AIA continuing-education program with the specific goal of reducing the embodied energy of building designs by 15 percent in the next five years.

-1/2

Require that state and federal government renovation projects reduce the existing building's energy use to meet an energy-consumption performance standard of one-half the U.S. regional average for that building type.

-1/2

Require that all government building projects be designed to meet an energy-consumption performance standard of one-half the U.S. regional average for that building type. "This is a no-brainer," Mazria says. "It doesn't tax the economy, it doesn't cost anything, nobody loses a job because of it. If the states and the federal government do that, I guarantee every architect who does government work will know how to do it within a year. And if you start with state and federal governments then everybody else will follow." Mazria adds, "Initially architects' fees could be increased by a small percentage to cover the cost of compliance."

+software

Begin a federally funded program "to refine and transform building-simulation programs so they are user friendly, graphic in format, and seamlessly integrated with the CAD programs used currently by architecture firms." Fully developed to mesh with existing computer-modeling design programs, such software would revolutionize sustainable architecture, according to Mazria. "For example, you'd be designing a room and there'd be a flashing warning saying, There's not enough daylighting there. And you'd make a change, and as soon as you got enough daylighting the program would tell you graphically."

+schools

Include in every "design studio" a requirement in the problems issued to students that architecture be designed to engage the environment in a way that significantly reduces or eliminates the need for fossil fuels. Offer computer-simulation and living systems courses to augment the design studio and provide students with a deep understanding of the principles involved in natural processes. Center a segment of state professional licensing exams on the design principles necessary to effect significant reductions in building energy consumption.

+20%

If implemented along with one nonarchitectural change—that 20 percent of the country's energy be produced by renewable sources within 20 years—Mazria believes such changes would eventually flatten out and even reverse the energy-use and greenhouse-gas curves.

=fixed

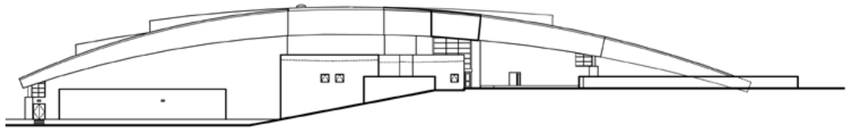
In all cases Mazria suggests that his targets should generally be met not through prescription ("Thou shalt use insulation at least ten inches thick and low-energy coated windows") or proscription ("Thou shalt never use redwood") but through pure design: siting, materials, and other strategies based in architecture more than a reliance on technology. When design cannot meet the targets, then renewable energies (i.e., solar, wind, geothermal) should be employed to make up the difference.

Genoveva Chavez Community Center

Santa Fe, New Mexico

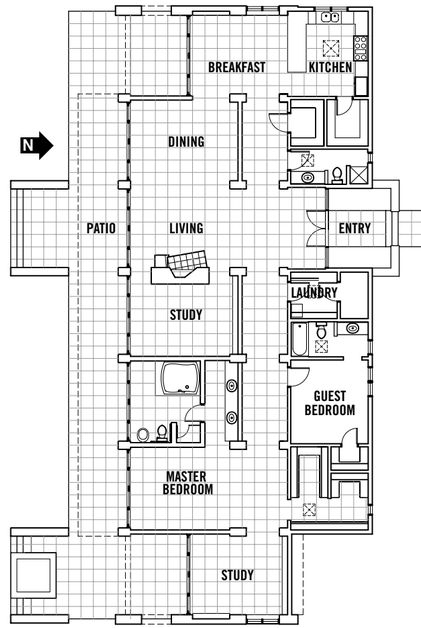
Tall south-facing clerestory windows light the pool area (above and left) and skylights illuminate the main gym (right). The nearly windowless west façade (elevation below) is designed to protect the interior from harsh direct rays.

"If you're an architect," Mazria says, "you must solve the environmental problem—and solve it by design."



Mazria/Kepler Residence

The 3,400 square-foot-home (plan right) uses south-facing glass walls (left) to warm it in winter. Masonry walls and floors in the dining and living areas (below) absorb heat and provide cool interior surfaces in summer and warmth in the winter.



Mazria hopes to have his Santa Fe home virtually off the grid by the end of the year.

Opposite page: courtesy Robert Reck. This page: photos Doug Hoeschler; plan courtesy Mazria Riskin Odems Inc.

Barely recognized in the 1970s, global warming is now undeniable. Since worldwide temperature measures began in 1867, the 15 hottest years have all been since 1980. Each of the top three has come in the last five years. Some scientists think average world temperatures will increase by ten degrees by 2100, a jump that would do almost unfathomable damage to the planet. Even the more conservative estimates of a rise between one and three degrees over that time promise changes, in the form of floods, drought, disease, and lost ecosystems.

"Here I am in fantasyland with this kid," Mazria recalls, "reading this stuff! Can you imagine? This is a huge experiment on the part of mankind that we're in the middle of. The stakes are so high. We talk about terrorism day in and day out, we talk about Iraq 24-7, but very little is being discussed about this global experiment that we're conducting on a scale that's absolutely unprecedented."

While the Bush administration continues to counsel patience in face of what it claims somehow to see as contradictory science—their favorite word when it comes to the global-warming threat is *uncertainty*—world temperatures keep going up. Atmospheric scientist Michael McCracken told Knight-Ridder **continued on page 149**

the environment. Many of them ended with projections for the year 2000, which at the time they came out, Mazria notes, had seemed like the distant future. Since then some of those texts have been tagged as part of the so-called "pessimist" school of environmental thought, challenged from time to time by neoconservative analyses suggesting that human inventiveness and technological development will combine to take care of whatever ecological problems we might bring upon ourselves. But Mazria found that, if anything, the projections in *The Limits to Growth* and other books had been frighteningly accurate.

Turning Down the Global Thermostat

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newspapers this summer that Bush's tack of continuing to ask for more study of the issue rather than beginning action to combat it "is a little bit like somebody sending a letter to the fire department trying to find out their capabilities when there is already smoke coursing through the house."

Mazria flew back to New Mexico with an inclination to recommit himself to sustainability. He began devouring more recent texts about fossil fuels, carbon, global warming, and other issues. But it wasn't until a couple of weeks later that he made the discovery that would turn his general eco-anxiety into a focused critique of his own profession.

Traditionally assessments of U.S. energy consumption have been broken down into four categories: industry, which consumes about 35 percent of the total each year; transportation, 27 percent; residential, 21 percent; and commercial, 17 percent. Significantly energy consumption usually tracks pretty closely with carbon dioxide production because most of the energy consumed is in the form of fossil fuels, which release greenhouse gases—primarily carbon dioxide, methane, and nitrous oxide. Thus a pie chart showing carbon dioxide divides along roughly the same ratios as one showing energy use. "In every study it's always broken down the same way," Mazria says, "so when you look at it and ask who the bad guy is—it's industry."

Mazria's eureka moment came when he decided to redraw that pie chart with a separate slice just for architecture. He did this by combining the residential and commercial sectors, and then adding the portion of the industry sector that goes to the operation of industrial buildings and their construction. To get this last group of numbers Mazria used estimates of the so-called "embodied energy" of industrial buildings. A key statistic for anybody hoping to build in a sustainable way, embodied energy is a measure of the total energy required to produce a particular material or building component and get it to a building site.

Mazria's new math brought the architectural sector to a whopping 48 percent of total U.S. energy consumption. A similar rearranging of the chart for carbon dioxide production left architecture with 46 percent of the total. "I rounded the numbers down," he says. "I want to be careful about my numbers because people are going to attack them."

What this means for Mazria is that the environmental movement has been scapegoating the wrong targets. "Look at SUVs," he says. "All the SUVs and trucks on the road account for about 6.5 percent of energy consumption in this country. If you figure SUVs as half of that, that's 3, maybe 3.5 percent. So even if you doubled the gas mileage of every single SUV on the road, you're talking about a marginal impact in a marginal area, all things considered. That kind of misguided focus actually keeps us from addressing the real issue." In other words, we're worrying about cars when we should be worrying about buildings. Indeed Mazria himself drives an SUV around Santa Fe, without apparent guilt.

Of all the suggestions out there for what the average citizen can do to combat global warming, few (if any) mention architecture. The list of suggested steps usually includes driving a fuel-efficient car, recycling, investing in clean energy sources like solar and wind power, and cutting back on electricity use at home and at the office. It would be profoundly refreshing to see just one list that suggested picking out a house or apartment building designed according to sustainable principles, when it's clear that that choice is more important—perhaps *six* times more important—than what kind of car you drive.

But is it fair to make architects responsible for the damage caused by the entire building industry? Mazria thinks so. He cites figures suggesting that architects design 77 percent of all nonresidential buildings, along with 70 percent of all multifamily and 25 percent of all single-family construction. And he argues that the percentage of architect-designed **continued on page 151**

Turning Down the Global Thermostat

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buildings is in fact higher than that because, as he writes, those figures "do not account for owner-supplied plans that were originally from architecture firms, designs by staff architects employed by building owners and developers, and single-family houses designed (but not stamped) by architects and interns."

In Mazria's mind, then, the architect is a perfectly legitimate new poster child for global warming: the leading part of the problem as well as, potentially, the solution. "Architects—and the government tends to forget this—specify every single material that goes into a building, from faucets to paint to carpet to wall materials to finishes to windows to roofing," he says. "Architects have the ability to change entire industries with the stroke of a pen. If we specify a material with low carbon dioxide emissions in its fabrication—say, floor tile, carpet, gypsum board—industry will respond. This is the American way. Architects are consumers; they're not always aware of the incredible power they have to change the way products are manufactured."

For Mazria the fact that architects are gatekeepers means that they control what he likes to call "the global thermostat." In that crucial role he sees signs of hope: "Because of the way design has always been taught in schools, I think architects tend to have a pretty highly tuned moral sense. And if architects understand the weight that's on their shoulders, they'll rally to do what they have to do."

He writes in his white paper: "We already know that buildings can be designed today to operate with less than half the energy of the average U.S. building at no additional cost. The design information needed to accomplish this is freely available."

Mazria has come up with a multipronged strategy to use architecture to attack the problem of global warming. He began to look at the five billion square feet of building space that goes up each year in this country, along with the additional five billion square feet of renovation, as a place where remarkable energy savings might be achieved. (See "Mazria's Equation" on page 104.) Indeed, if implemented along with one nonarchitectural change—that 20 percent of the country's energy be produced by renewable sources within 20 years—Mazria believes such changes would flatten out and even reverse the energy-use and greenhouse-gas curves. In all cases Mazria suggests that his targets be met not through prescription ("Thou shalt use insulation at least ten inches thick and low-energy coated windows") or proscription ("Thou shalt never use redwood") but through pure design: siting, materials, and other strategies based in architecture more than a reliance on technology.

"That's the beauty of it," he maintains. "This is design with a capital *D*. Architects who don't want to see this as their problem will try to rationalize why they can't reach these goals—that it's a client problem, or it's an economic issue and clients don't want to spend the extra money. But it's simply a design problem—you can solve a design problem a thousand ways to not cost more. If you're an architect, just like you solve the functional problem and the budgetary problem, you must solve the environmental problem—and solve it by design." That holistic approach is one Mazria has put to use in the design of his own house, in the foothills east of Santa Fe, which he hopes to have practically off the grid by the end of the year, and in many of his firm's best-known projects—including the 173,000-square-foot Genoveva Chavez Community Center in Santa Fe, which uses significantly less energy per square foot than a typical building of its type.

The approach has also led the architect to criticize more quantitative and regulatory green initiatives, including the U.S. Green Building Council's LEED certification program, which is currently the most expansive one in use in this country. "LEED-type programs can actually be damaging," Mazria says, "because they shift decisions about continued on page 152

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sustainability out of the realm of design at the workplace and put it in a separate, purely technical category. So every firm needs to get one person LEED certified, and they usually send the technical guy, not a design guy. And then that technical guy becomes the guy who has to get your design in shape for LEED, and that process becomes divorced from design."

Over time he has softened those critiques, realizing that they won't do him any good in winning converts. "I don't want to alienate those people who are doing wonderful things," he says. "Still, it's a matter of how quickly we move. Sustainable design so far has moved in the right direction, but it hasn't really made a dent overall."

Generally speaking, the experts who've had a chance to review Mazria's findings suggest that his most important point is also his most basic: the reslicing of the energy-consumption and emissions pie charts. "Rearranging the pie the way he does certainly makes for a powerful argument," says Judi Greenwald, director of Innovative Solutions at the Washington-based Pew Center on Global Climate Change. "I think that if you had thousands of better-educated architects who were really thinking about this stuff, it would make a huge, huge difference. But I'm not sure it makes sense to focus so much on a single source the way he's doing. Global warming is caused by a thousand different sources, and we think it's important to focus attention on as many of them as possible. We have a saying here: There's no silver bullet, only silver buckshot."

Nigel Howard, a British native who is vice president for LEED and International Programs at the U.S. Green Building Council in Washington, agrees with that analysis. "It's not just the architect—it's the architect, the client, the cost consultant, the engineer. Everybody involved in every building project has to look through an environmental lens."

There are other liabilities in Mazria's approach. While energy use in the U.S. is predicted to rise by 37 percent over the next 20 years, the worldwide figure for the same period is 59 percent. This is *global* warming, not American warming, that we're talking about here. We do consume significantly more energy per capita than any other nation in the world, but it's also true that only a fraction of all the square feet of new construction in the world each year takes place in this country. Developing countries—China and India most notably—are not likely to respond well to high-toned calls from the United States to implement aggressive new energy-efficiency and greenhouse-gas guidelines.

But it's important to remember that people like Greenwald and Howard swim in an ocean of depressing environmental data each day. They have almost given up on trying to find a way to convince the general public, or even the design community, just how shocking the numbers look when it comes to global warming. "I feel like I've been preaching this same message for fifteen years," Howard says. "For me it's old news."

In that sense the power of Mazria's approach is that—in an age of hysterical but convoluted statistics and greenwashing from the forces of industry—it delivers a clean, clear message: architects bear a greater burden of responsibility for environmental damage than the members of any other single profession. People like Greenwald and Howard may not be surprised to hear that, but you can bet that the man on the street—and pretty much every architect in America—will be. "When I tell groups of architects that so much responsibility lies on their shoulders, it's a little bit of disbelief," Mazria says. "Shock, even. But when you're an architect and you start to think about your role, and the kind of future you're leaving to your kids and grandkids, you start seeing everything differently. You have to. You start seeing every single building on every street differently—as a producer of emissions, as a symbol of inefficiency—as a *threat*."

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