
GREEN
ARCHITECTURE NOW!
GRÜNE Architektur heute!
L'architecture VERTE d'aujourd'hui!
Philip Jodidio
TASCHEN

# DAVID HERTZ

*David Hertz Architects, Inc.*
*SEA, Studio of Environmental Architecture*
*1920 Olympic Boulevard*
*Santa Monica, CA 90404*
*USA*

*Tel: +1 310 829 9932*
*Fax: +1 310 829 5641*
*E-mail: info@studioea.com*
*Web: www.syndesisinc.com; www.studioea.com*

**DAVID HERTZ**, born in 1960 in Los Angeles, received his B.Arch degree from SCI-Arc in 1983. He worked as an apprentice in the offices of John Lautner and Frank Gehry before founding his own firm in 1984. He is the founder and president of SEA, the Studio of Environmental Architecture (formerly Syndesis Inc.). He is a member of the Los Angeles Chapter of the American Institute of Architects Committee on the Environment, the Environmental Affairs Committee of the Construction Specifications Institute, the Environmental Committee of Concrete Organizations, and the California Energy Commission's High Performance Wall Systems Collaborative. In 2004 he became a LEED AP, administered by the US Green Building Council. His work includes the Panel House, a single-family residence made of prefabricated refrigeration panels (Venice, California, 2006), and his own office, installed in a renovated market and restaurant using "cutting-edge green building technology" (Santa Monica, California, 2007, LEED Platinum registered). Current work includes the 747 Wing House (Santa Monica Mountains, Malibu, 2007–09, published here); the Mullin Collection Automotive Museum (Oxnard, California, 2009); the North Cache Project, a sustainable mixed-use complex (Jackson Hole, Wyoming, 2010); and Living Homes, the "design of a systemized aluminum frame and panel prefab house design that is ordered as a kit of parts and integrated systems" (no location, ongoing).

**DAVID HERTZ**, 1960 in Los Angeles geboren, erhielt seinen B.Arch. 1983 an der SCI-Arc. Bevor er 1984 sein eigenes Büro gründete, war er Praktikant bei John Lautner und Frank Gehry. Er ist Gründer und Direktor von SEA, dem Studio of Environmental Architecture (vormals Syndesis Inc.). Er ist Mitglied des Ortsverbands Los Angeles des Umweltkomitees des American Institute of Architects, des Komitees für Umweltfragen des Construction Specifications Institute, des Umweltkomitees der Betonverbände sowie der Arbeitsgemeinschaft Hochdämmende Wandsysteme der kalifornischen Energiekommission. 2004 wurde er für das LEED-AP-Programm des amerikanischen Green Building Council akkreditiert. Zu seinen Projekten zählen das Panel House, ein Einfamilienhaus aus vorgefertigten Kühlpaneelen (Venice, Kalifornien 2006), sowie sein eigenes Büro, das nach „neuesten grünen Baumethoden" in ein saniertes Markt- und Restaurantgebäude integriert wurde (Santa Monica, Kalifornien, 2007, registriert für eine LEED-Platin-Medaille). Zu seinen aktuellen Projekten gehören das 747 Wing House (Santa Monica Mountains, Malibu, 2007–09, hier vorgestellt), das Mullin Collection Automotive Museum (Oxnard, Kalifornien, 2009), das North Cache Project, ein nachhaltiger Gebäudekomplex mit gemischter Nutzung (Jackson Hole, Wyoming, 2010), sowie Living Homes, der „Entwurf für ein Fertighaussystem aus Aluminiumrahmen und -paneelen, das als Bausatz aus Einzelteilen und integrierten Haustechnikelementen bestellt werden kann" (ohne Ort, in Arbeit).

**DAVID HERTZ**, né en 1960 à Los Angeles, est B. Arch de SCI-Arc (1983). Il a été apprenti dans les agences de John Lautner et Frank Gehry avant de fonder sa propre agence dès 1984. Il est fondateur et président de SEA, Studio of Environmental Architecture (anciennement Syndesis Inc.). Il est membre du comité pour l'environnement de la section de Los Angeles pour l'Institut américain des architectes, du Comité des affaires environnementales de l'Institut des normes de la construction, du Comité environnemental des professions du béton et membre de la Commission californienne de l'énergie pour le projet collaboratif sur les systèmes de murs à hautes performances. En 2004, il a reçu l'accréditation 2004 LEED AP, gérée par l'US Green Building Council. Parmi ses réalisations : la Panel House, résidence familiale en panneaux réfrigérants préfabriqués (Venice, Californie, 2006) et ses propres bureaux, installés dans un marché et restaurant rénovés au moyen de « technologies vertes d'avant-garde » (Santa Monica, Californie, 2007, LEED Platine). Actuellement, il travaille sur la maison 747 Wing (Santa Monica Mountains, Malibu, 2007–09, publiée ici) ; le Mullin Collection Automotive Museum (Oxnard, Californie, 2009) ; le projet North Cache, complexe mixte durable (Jackson Hole, Wyoming, 2010), et Living Homes, la « conception d'une maison à ossature et panneau d'aluminium systémisés, qui se commandera en kit et sera livrée accompagnée de systèmes intégrés ».

# 747 WING HOUSE

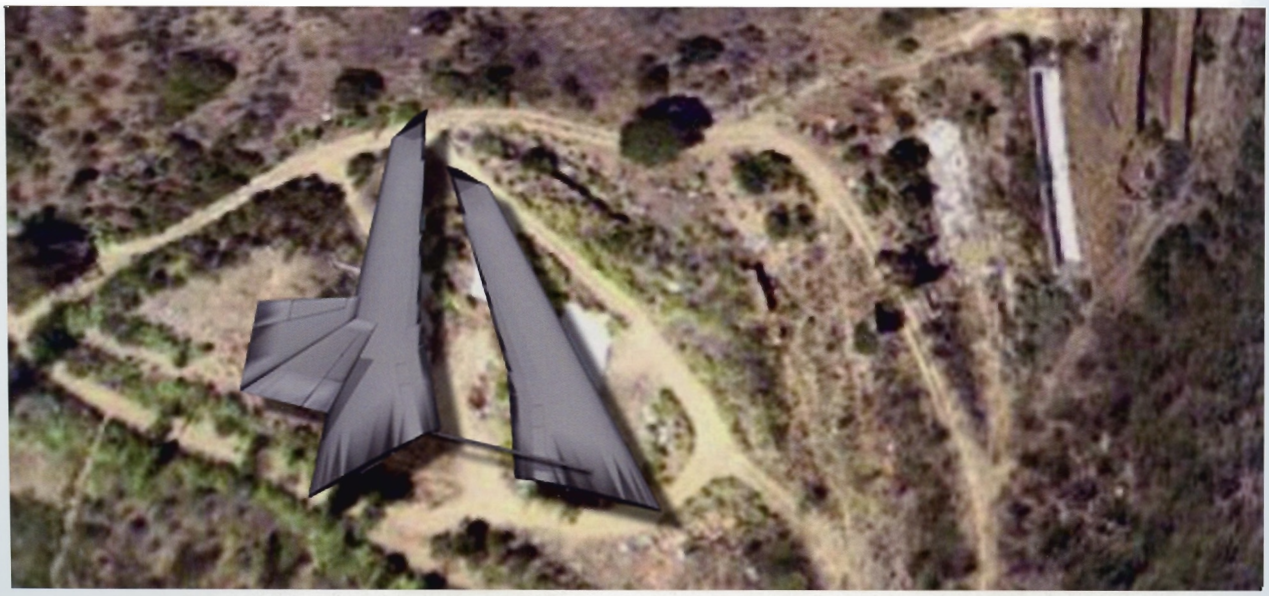
## *Santa Monica Mountains, Malibu, California, 2007–09*

*Site area: 22 ha. Floor area: 464 m². Client: Francie Rehwald.*
*Cost: not disclosed*

The client for this project asked the architect to design a house with "curvilinear, feminine shapes." The architect's original idea of a curved roof that would appear to float gave way to the use of the 230-square-meter wings of a decommissioned 747–200 aircraft purchased for a price of just $40 000. Considering the ecology of the entire site, Hertz decided to use components of the aircraft for several structures on the property, all of which are designed with passive solar orientation and natural ventilation strategies. As he says: "The recycling of some of the 4.5 million parts of this 'big aluminum can' is seen as an extreme example of sustainable reuse and appropriation." The strength and lightness of aircraft components is, of course, something that other architects have made use of before, but none has gone as far as Hertz in their direct reuse. Both of the main wings of the aircraft, as well as its two horizontal stabilizers from the tail section, are employed as roof elements, while the ailerons and elevators of the plane "are proposed to be made operational and will be used as kinetic solar shades as well as airfoils to regulate airflow of the prevailing breezes for ventilation."

Der Bauherr bat den Architekten um ein Haus mit „weichen, femininen Formen" Die ursprüngliche Idee des Architekten eines geschwungenen, scheinbar schwebenden Dachs wurde schließlich durch den Einsatz der 230 m² großen Tragflächen einer ehemaligen Boeing 747–200 abgelöst, die für nur 40 000 US-Dollar erworben werden konnten. Nachdem Hertz die Ökologie des gesamten Geländes analysiert hatte, beschloss er, Flugzeugkomponenten für verschiedene bauliche Elemente auf dem Grundstück einzusetzen, die durch ihre Ausrichtung als Passivbauten angelegt sind und natürlich belüftet werden. Er merkt an: „Das Recycling verschiedener Elemente der insgesamt 4,5 Millionen Teile einer solchen ‚gigantischen Aluminiumdose' kann als Extrembeispiel für nachhaltige Wiederverwertung und Umnutzung gelten." Natürlich wurden die Stabilität und Leichtigkeit von Flugzeugteilen bereits von anderen Architekten erkannt, doch niemand trieb die unmittelbare Wiederverwertung bisher soweit wie Hertz. Die beiden Haupttragflächen des Flugzeugs ebenso wie die beiden Höhenflossen vom Heck dienen als Dachelemente, während die Querruder und Höhenruder „funktional erhalten bleiben, um als kinetische Sonnensegel und aerodynamisches Profil zu fungieren, mit deren Hilfe die vorherrschenden Windströme reguliert und für die Belüftung nutzbar gemacht werden können".

Le client avait demandé à l'architecte une « maison de formes curvilignes, féminines ». L'idée d'origine d'un toit incurvé qui aurait semblé suspendu a laissé place aux 230 m² d'ailes d'un vieux 747–200 achetées pour à peine 40 000 dollars. Prenant en compte l'écologie du site, Hertz a décidé d'utiliser des éléments de l'avion pour plusieurs constructions édifiées sur la propriété, toutes conçues selon des stratégies d'orientation solaire et de ventilation naturelle. « Le recyclage de quelques-unes des 4,5 millions de pièces de cette "grosse boîte d'aluminium" est un exemple extrême de réutilisation et d'appropriation durables », a commenté l'architecte. La résistance et la légèreté de ces pièces d'avion étaient conçues par d'autres architectes avant lui, mais personne n'était allé aussi loin dans leur réutilisation. Les deux ailes et les deux stabilisateurs horizontaux de la section de queue ont servi pour la toiture, tandis que les ailerons et les gouvernails de l'avion « devraient être rendus fonctionnels pour servir d'écrans solaires cinétiques ou de régulateurs de flux des brises dominantes récupérées pour la ventilation ».



*The wing forms of the house are clearly visible in the aerial view above. Separated in this way, the wings might even resemble those of a bird in flight.*

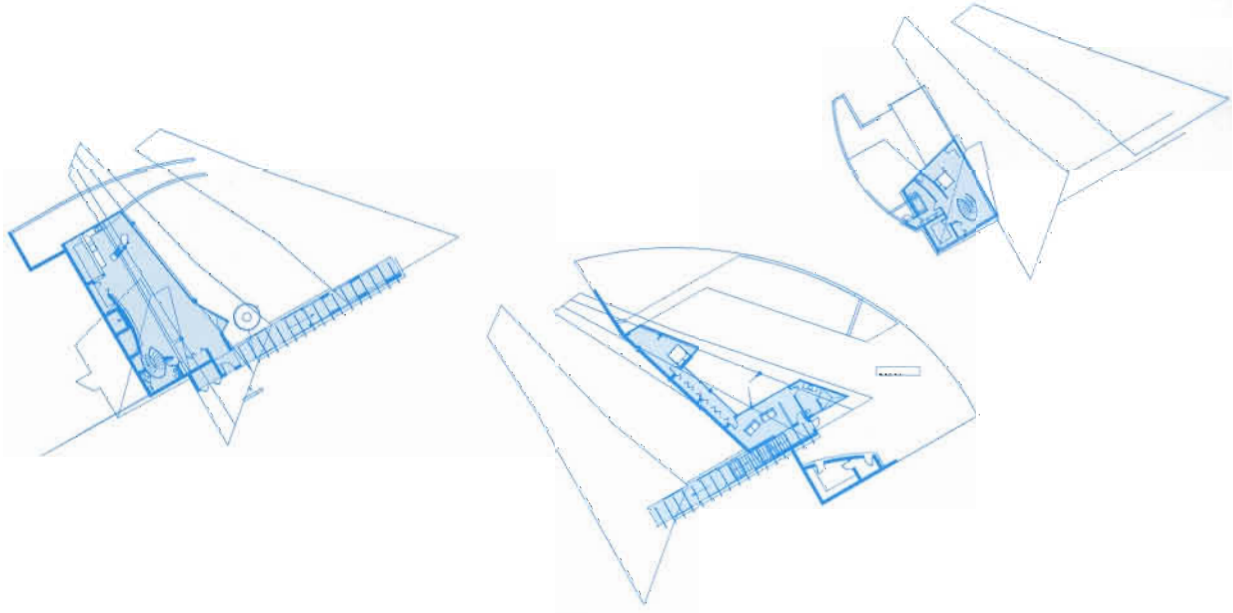
*Im Luftbild (oben) sind die Tragflächen des Hauses deutlich zu erkennen. So voneinander getrennt mögen sie vielleicht sogar an die Flügel eines fliegenden Vogels erinnern.*

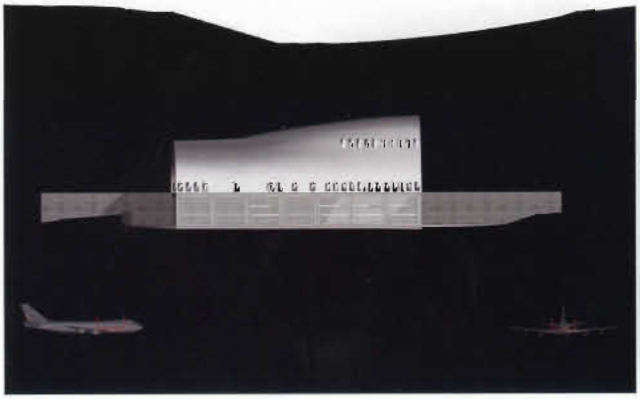
*Les ailes de la maison sont clairement reconnaissables dans cette vue aérienne. Ainsi séparées, elles font presque penser à évoquer un oiseau en vol.*

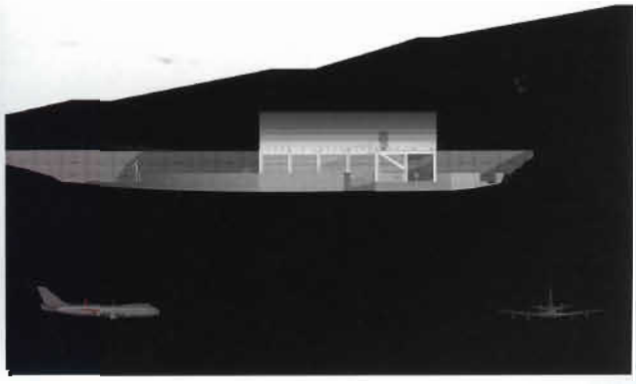
*Other drawings and plans give a less literal impression of the wing design, sublimating it rather than rendering it fully explicit.*

*Andere Zeichnungen und Grundrisse zeigen weniger offensichtlich, wie die Tragflächen in den Entwurf eingearbeitet wurden – eher verhalten als explizit.*

*D'autres plans et dessins affichent beaucoup moins clairement les ailes, les sublimant plutôt que de les rendre explicites.*







# INTRODUCTION

## WAR IN THE ASPHALT JUNGLE

Green is the name of the game, no doubt about it. There has never been so much interest in the ecological impact of buildings as there is today. In the United States alone, the value of green building construction is projected to increase to $60 billion by 2010.[1] Nor is this a negligible fact in the struggle to control pollution and in the search for responsible "sustainable" methods of construction. Buildings are one of the heaviest consumers of natural resources and account for a significant portion of the greenhouse gas emissions that affect climate change. In the United States, buildings account for 39% of all $CO_2$ emissions.[2] Buildings use 40% of raw materials globally.[3] The difficulty is that green is so fashionable that everyone is jumping on the bandwagon, claiming astonishing sustainability or remarkably low-energy consumption. One effective response to the uncertainty surrounding the complex question of the environmental impact of architecture has been LEED (Leadership in Energy and Environmental Design), the accepted benchmark system of the US Green Building Council (USGBC) for the design, construction, and operation of green buildings. According to the USGBC, "LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality." The USGBC certifies not only buildings but building professionals. More than 46 000 building professionals from all areas of practice have become LEED Accredited Professionals (APs) since the Professional Accreditation program was launched in the United States in 2001.

The Green Building Council system takes into account the various professions that participate in construction, and not only architects. This broad-based rating organization is undoubtedly much closer to the goal of encouraging real sustainability in architecture than would be individual architects claiming that their structure is greener than the next. It may even be asked, with global warming now a significant international political issue, if architecture itself is not on the brink of very significant changes, where style and matters of aesthetics are placed in a secondary position behind issues of sustainability. At a certain time, "green" buildings were almost obliged to show their colors, as it were, ugly and complicated affairs, usually multicolored as though an entire rainbow in one building might be sufficient to prove a concern for ecology. Technology certainly assists architects by giving them environmentally "correct" materials that are also attractive. Thermal glass, as used by designers such as the German Werner Sobek, allows a glazed house to be as environmentally friendly as one covered in larch shingles. Photovoltaic cells are becoming more efficient as well, though they are not yet often able to provide more than a relatively small percentage of the energy consumption of a building. This of course depends on climate, with gray skies a less propitious to photovoltaic panels than desert sun, of course. As it is, some sustainability methods, be they passive or active, are hardly visible. Turning a building the right way around or organizing its cladding properly to avoid solar gain may have little or no effect on its overall aesthetics. So, too, photovoltaic panels are usually safely tucked away on the roof, unless architects are still trying to make a "statement" with their patchwork sun-seeking technology.

1

*1*
*David Hertz, 747 Wing House, Santa Monica Mountains, Malibu, California, USA, 2007–09*

## TODAY CALIFORNIA, TOMORROW THE WORLD

The UK Green Building Council (UK-GBC) was launched in February 2007 to bring cohesion to the green building movement in the United Kingdom. The Government's Sustainable Buildings Task Group had earlier reported that no one body or organization concerned with sustainability was providing clear direction for the sector as a whole. The UK-GBC was established to fulfill this role. Both the American and English groups are part of the WorldGBC, which "supports national Green Building Councils whose common mission is to create a sustainable built environment through market transformation." The WorldGBC held its founding meeting in 1999 in San Francisco, with eight countries in attendance. There are currently 12 national councils and a further 16 countries with emerging Green Building Councils. Current members are Australia, Brazil, Canada, Germany, India, Japan, Mexico, New Zealand, Taiwan, the United Arab Emirates, the United Kingdom, and the United States. These nations represent over 50% of global construction activity, though efforts toward sustainability have varying effectiveness in each country.

Other countries have set up similar councils to control the environmental qualities of buildings. One example is MINERGIE®, "a sustainability brand for new and refurbished buildings… mutually supported by the Swiss Confederation, the Swiss Cantons along with trade and industry, and registered in Switzerland and around the world…" In a ten-year period, 7200 buildings for a total of 6.5 million square meters have received a MINERGIE® rating certificate, and the system is also being employed in France.

Although the GBC system is gaining ground and some communities or government entities are beginning to make their requirements part and parcel of the legal obligations of architects and builders, there are also doubts. Surveys show that many corporate leaders in the United States, for example, are convinced that green architecture costs more than a "normal" building. A GBC study of buildings in California found that "green improvements pay for themselves in three years." *The New York Times* recently published an article outlining a number of the ideas and issues that pose problems for the advancing green wave. One is that green buildings are ugly. This misconception is probably due to a long history of architects who felt that an environmentally friendly building had to somehow look the prickly part. Kelly Meyer, an environmentalist cited by *The New York Times*, is trying, with her husband, who is a developer, to prove that "something energy-conscious doesn't have to look as if you got it off the bottom shelf of a health-food store. It doesn't have to smell like hemp."[4]

## ON A WING AND A PRAYER

David Hertz, one of the architects selected for this book, feels that the GBC LEED standards are "rigid and cumbersome" and indeed the certification process is complex and potentially costly in itself.[5] Hertz has come up with an innovative way to integrate the wings of a decommissioned 747 aircraft in a new house (747 Wing House, Santa Monica Mountains, Malibu, California, USA, 2007–09, page 185). This sort of reuse, as dramatic as it might be, may not suffice to allow Hertz to garner a precious platinum medal, but he seems set to rebel against the bureaucratic aspects of the GBC rating system. Another architect quoted in the same article in *The New York Times*, Michael B. Lehrer, is predictably a bit more positive about the LEED certification process since his Water + Life Museum (Hemet, California, USA, 2001–06, page 219) recently became the first LEED Platinum museum: "They have mundane things in there that are pretty nonsensical and other things that

2

3

are pretty profound. At a time when everybody and their sister and brother are saying 'We are green,' it's very important that these things be vetted in a credible way."[6]

On a more positive note, the LEED standards and similar initiatives elsewhere do approach environmental issues in a broad-based or even holistic manner that ranges from encouraging the use of natural light to reducing waste—factors that architects alone can influence but not control totally in many cases. The GBC thus involves not only architects but also a broad variety of "building professionals," all engaged in producing a more "sustainable" result. But this book is not only about LEED-Platinum (the highest rating) buildings, nor about the architects who now tack the unattractive acronyms "LEED AP" to their names wherever they go. Rather, it is about the variety of different efforts that weave a relationship between the built environment and nature, in a positive sense. The *Architecture Now!* series focuses not on the technical aspects of buildings, but precisely on their architectural quality. Though Kelly Meyer is surely right when she says that a green building "doesn't have to smell like hemp," it is also true that not every structure that claims to have some respect for the environment is good architecture. The LEED system may well be a good way to reduce false claims of a "zero carbon footprint" or abusive sales based on "sustainability," but the very fashionable aspects of "green" make all kinds of manipulation of the truth possible. The projects presented in this book range from concept houses to very large complexes, and include parks, a gas station, and a frozen vault for seeds. The point is that there are many ways to approach the issue of the relationship between the environment and architecture.

The broad public appeal of a movie such as Al Gore's *An Inconvenient Truth*, based on the growing evidence of "global warming," together with the proportion of world resources used for construction, makes a clear and pressing case for the need for architects to face up to their own responsibilities. Only one or two of the buildings in this book "smell like hemp" and it has already become obvious that sustainability and good architecture can indeed go hand in hand.

### LET A THOUSAND GARDENS BLOOM

One very old method to improve sustainability is to bury architecture, or to cover it with vegetation. A layer of earth serves as insulation and ultimately allows nature to return to its rightful place on a given site. Bringing nature into a city center provides relief from an otherwise artificial environment (a fact that has more psychological impact than real influence on such vast problems as global warming), but it might be said, too, that every little bit helps in a struggle that will surely engage tens of millions of people in the foreseeable future. At opposite ends of the United States two green roofs of very different size show different ways of bringing the strength of nature to bear on an architectural context. In Washington, D. C., Michael Van Valkenburgh has created a 130-square-meter Green Roof for the building of the American Society of Landscape Architects (2005–06, page 385). Using artificial materials to make lightweight mounds, he in a sense invents a new landscape in a very small area, providing users not only with a bit of greenery, but also changing their perspective on the city. Given that roof space is generally underused and ugly in most cities, this project might be seen as a small example of what might be done on a much larger scale, given sufficient public interest and financial incentive. The green roof imagined by Renzo Piano for the new California Academy of Sciences in San Francisco (2005–08, page 277) is on an entirely different scale and has different ambitions. Covering approximately one

*2*
*Tadao Ando, Chichu Art Museum/Naoshima, Naoshima, Kagawa, Japan, 2000–04*

*3*
*Tadao Ando, Tokyu Toyoko Line Shibuya Station, Shibuya-ku, Tokyo, Japan, 2005–08*

hectare and planted with 1.8 million native California varieties, the roof is a key element in the environmental strategy of the structure, which is to become the second American museum to receive a LEED Platinum rating. The coating of earth on the building permits a 6° reduction in internal temperatures in summer leading to an obvious saving on air-conditioning costs, for example.

The French botanist Patrick Blanc has taken a different approach to greening the city. His recent 600-square-meter CaixaForum Vertical Garden (Madrid, Spain, 2006–07 page 91 is located in the heart of the Spanish capital, just across the street from the Prado Museum. It is set on a façade at right angles to the entrance of the new CaixaForum exhibition building designed by the Swiss team Herzog & de Meuron. Blanc has patented a method for growing plants on vertical walls without the use of earth. Aside from the incongruous aspect of seeing a complete garden suspended on a building's façade, there is something to be said for making use of otherwise difficult bits of the urban surface. Just as Michael Van Valkenburgh and many others have taken to greening roofs, so, too, has Patrick Blanc begun to do the same for walls that resemble works of art and bring a breath of fresh air to the congested urban environment.

Although their method is extremely different from that of Patrick Blanc, the Spanish team Ecosistema Urbano has also contributed in Madrid to a growing awareness of problems of pollution and the disappearance of green areas. Their Ecoboulevard of Vallecas (Madrid, Spain, 2006, page 127) consists in a series of three "air trees," conceived as ephemeral installations that use photovoltaic cells to power the dispersion of very fine water vapor near passersby. This water-vapor technique is well known and can lower ambient temperatures by as much as 10°C, a boon in Madrid's sweltering summers, and an encouragement to the congregation of local people. Artificial trees, of course, have a long history in architecture, surely beginning with the column and continuing through Postmodern visitations concocted by such figures as Hans Hollein in Vienna. The Ecosistema Urbano technique takes this architectural metaphor a large step further, making the artificial "tree" do something that a real forest does, lower temperatures and make places agreeable.

## FRESH MINT FOR ME

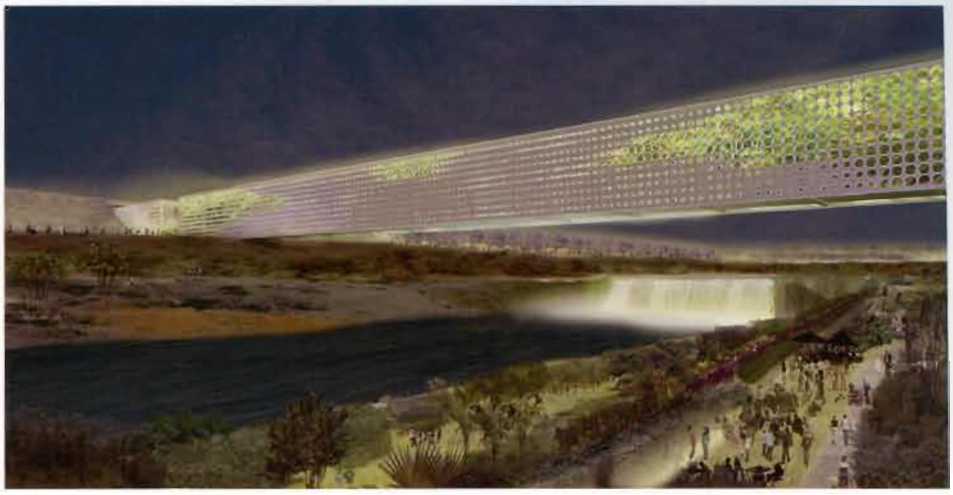
Another young designer the French-Swiss architect Philippe Rahm, has begun to make a career out of imagining architectural environments in which fundamental factors such as the oxygen content of the air are modified with an aim to alter the physical states of visitors. His latest scheme, called the Digestible Gulf Stream (11th Venice Architecture Biennale, Italy, 2008, page 291), is a small residence in which one level is maintained at 12°C and the other at 28°C, since these are calculated to be the two extremes that are considered "comfortable" by most people. Rahm maintains, rightly, that air conditioning, heating, and other forms of architectural environmental control are systematically geared to maintain a "normal" set of conditions that few people ever bother to question unless they are uncomfortable. He says, on the contrary, that it is precisely by challenging these norms that architecture can branch off into new directions, fundamentally related to physiology, for example. For this project, Rahm also experiments with the idea that edible substances like mint (menthol) can create a sensation of cooling that is unrelated to the usual set of refrigerating machinery that hums just out of sight and out of mind in just about all modern buildings.

## ISLANDS IN THE STREAM

The Japanese architect Tadao Ando has long been interested in the idea of building underground, which may indeed sometimes have a bearing on the issue of "green" design. As he said in 2003: "I have an almost unconscious inclination towards underground spaces. Whatever the nature of the site, try to create architecture that is never imposing on its environment. Working on underground space links up with the search for the origins of architecture."[7] One of Ando's recent works is the Chichu Art Museum/Naoshima (Naoshima, Kagawa, Japan, 2000–04, page 61). The word *chichu* means "underground" in Japanese, and this building is almost entirely invisible from the neighboring hillsides. The luxuriant vegetation of the island assures that nothing but the skylights and open courtyards betray, at ground level, the presence of a building. Although Ando's declaration makes more reference to an architectural concept than to issues of environmental protection, the Island of Naoshima in Japan's Inland Sea, where he has built other structures, is now in good part a nature reserve after having long served mining interests. It may be interesting to note that Ando does not employ the newly fashionable vocabulary of "green" design very often, but the thick concrete walls he creates, and in the case of the Chichu Art Museum, a layer of earth covering the entire building, make for a very significant passive energy strategy. The inside of the Museum also relies in good part on natural light. A second and more recent project by Ando is his Tokyu Toyoko Line Shibuya Station (Tokyo, Japan, 2005–08, page 66). Here, a 27 725-square-meter subway station in the heart of one of the densest urban areas in the world boasts a natural ventilation system. Thus it is all the more surprising, since Tokyo's extensive subway lines are in large part air conditioned given the high summer temperatures.

## SMALL PARK, GREAT CANYON

Although architects are now fond of parading their LEED AP visiting cards, another more traditional way of contributing to environmental quality is simply by encouraging nature, in the form of parks. Two examples of such interventions, one tiny and another massive, show that landscape architecture is part and parcel of any effort to draw attention to issues of sustainability. The small (815 $m^2$) Samir Kassir Square in Beirut (Lebanon, 2004, page 117) by Vladimir Djurovic was designed around two large ficus trees that had somehow survived Beirut's years of civil war—"in essence, to become a small escape dedicated to the city and its people," says Djurovic. Despite its relative modesty, this project did not escape the attention of the jury of the 2007 Aga Khan Award for Architecture that singled out Samir Kassir Square for its contribution to a city where Muslim and Christian populations rarely find new places to rest. On a much larger scale (51 $km^2$), the US-based firm EDAW, where Djurovic first worked, developed the Jinji Lake Landscape Master Plan for the historic city of Suzhou (China, 2002–04, page 135). Situated about 60 kilometers from Shanghai, Suzhou is famed for its canals and gardens. In 514 BC, during the spring and autumn period, King Helu of Wu established the "Great City of Helu," the ancient name for Suzhou, as his capital. When the Grand Canal was completed, Suzhou found itself strategically located on a major trade route. In the course of the history of China, it has been a center of industry and commerce. It has been called "the Oriental Venice," but pollution and rapid development threatened the city until its administration began a concerted effort to clean the water and create new green areas. EDAW's specific projects within the overall master plan include the five-hectare Jinji Lake Cityside Harbor, and the seven-hectare Maple Forest Park. Books on "green" architecture might tend not



4

*4*
*Ken Smith Landscape Architect, Orange County Great Park, Irvine, California, USA, 2007–*

to mention landscape design, and yet this is one of the most obvious ways to assist other efforts to counter pollution and, indeed, the stress associated with urban life.

Another very large park design, the Orange County Great Park (Irvine, California, USA, 2007–, page 333), is the work of the New York landscape architect Ken Smith. Smith was responsible for the Museum of Modern Art Rooftop Garden (2003–05) on the top of Yoshio Taniguchi's expansion of the MoMA. At least partially for technical reasons, including weight considerations, the MoMA garden is entirely artificial, made of plastic rocks, crushed glass and recycled rubber mulch. Within the 545 hectares of the park in Irvine, Smith plans a more"natural" intervention—including a "great canyon" 3.2 kilometers long and nine meters deep, corresponding to streams that existed on the site before it was a Marine Corps Air Station. A hot-air balloon already allows visitors to view the site, but several years of work are necessary before the new complex, including a botanical garden and many biking and walking trails, will be ready.

The play on nature and artifice seen in the work of Ken Smith recalls that just as "green" architecture is difficult to define, so, too, is the presence of nature in architecture. The Japanese, with such figures as Itsuko Hasegawa or Toyo Ito, have long posited that architecture should engage in the creation of an artificial "nature" inspired by the forms of the natural world and yet decidedly manufactured in their aspect. The American specialist in biomimetics, Dennis Dollens, uses Xfrog software, which consists of "botanic, L-system algorithms used in computational biological simulations to grow plants and landscapes for laboratory tests and simulations." Of his various attempts to design towers or bridges that have a relation to the natural world, Dollens says: "The unifying concept behind these projects is that computational growth of architectural structures and systems can be influenced by biomimetic observations without falling into traditional categories of 'organic architecture. In addition, the potential of biological science, biotechnology, and digital manufacturing, arriving at a union where architectural production and new possibilities for non-toxic architecture come together begins to make sense" (see his Tree Tower, Los Angeles, California, USA, 2009, page 123). Unlike some architects, who seem content to state that a wooden house is "sustainable," Dollens is looking forward to new applications of computer science that might allow architecture itself to change, becoming somehow more like nature and thus less "toxic."

## SMELLS LIKE HEMP

Traditional construction methods employed across a good part of the planet of course produce nowhere near the levels of pollution of a "modern" building. This fact has inspired a number of architects who have sought not only to help people in need, but also to call on their own building techniques to produce structures that are both durable and truly "sustainable." A good example of this approach is that of Anna Heringer and Eike Roswag. Their Handmade School in Bangladesh (Rudrapur Dinajpur 2005, page 179) is a 325-square-meter structure made of earth and bamboo for a cost of just 25 000 euros. Another winner of the 2007 Aga Khan Award for Architecture, this project calls on some modern materials such as nylon lashing, but it provides both shelter and a joyous place for children to learn, while having very little negative effect on the environment and boasting low energy consumption. The Salam Center for Cardiac Surgery (Soba, Republic of Sudan, 2006–07 page 351 by the Italian group studio tamassociati was built entirely around two large existing mango trees. A 58-centimeter-thick

5

6

wall made of two layers of bricks separated by an insulating air cavity, 1000 square meters of solar panels, and a water-vapor system used for cooling or keeping dust out are some of the "green" features of a building created where people simply cannot afford to use the typically wasteful construction methods of Western, or developed Eastern, countries. Apparently more "modern" in its appearance than the Handmade School, the Salam Center is nonetheless a creative approach to using local materials to the greatest extent possible, while also calling on more sophisticated technology (solar panels). Christine's House (Mason's Bend, Alabama, USA, 2005–06, page 309) is another example of the creative work done by architecture students at Auburn University, as part of the Rural Studio program founded in 1993 by the late Samuel Mockbee to help poor Alabama residents. Making use of the area's abundant red clay, mixing 70% earth, 25% pulped newspaper and 5% Portland cement, and pouring it into cardboard boxes of various sizes to make bricks for two main walls of the house, the students showed that simple methods and a good design result in architecture that is both pleasant and environmentally responsible.

### AIMING FOR ZERO

Houses of various sorts have been a fruitful area for experimentation with different concepts of sustainability, because well-meaning owners are willing to pay a bit more to be "ecologically responsible." The German engineer Werner Sobek is one of the great specialists of sophisticated architecture that is as close to true sustainability as would appear possible given the present state of technology. His H16 house (Tieringen, Germany, 2005–06, page 337) is larger than ecology might suggest at 454 square meters, but it attains "maximum transparency and a minimum of structure, full recyclability and zero emissions." The energy consumption of the house is influenced by passive methods such as varying transparent or opaque volumes in function of their exposure to the sun, but geothermal heating with a heat pump, as well as photovoltaic panels, also contribute to the overall sustainability of the residence. Most importantly, Sobek succeeds in creating an attractive modern house while fully respecting the highest standards of regard for the environment—proof that green need not be ugly. Zoka Zola's Rafflesia Zero Energy House (Kuala Lumpur Malaysia, 2007–09, page 407) is not yet built, but this competition-winning project uses a broad variety of strategies to fit into its environment with minimum disruption to the ecosystem, and also succeeds in using little, if any, energy from the outside grid. A 50-centimeter void in the roof used as insulation, careful study of natural air movements, and extensive surfaces covered by solar panels are amongst the ideas employed here.

With houses like H16 or Rafflesia taking form, it might seem inevitable that architects would engage in a healthy kind of one-upmanship, each trying to outdo the other when it comes to sustainability. In a project for *The New York Times Magazine*, the New York architects Diller Scofidio + Renfro appear to have gone about as far as possible with their Phantom House (southwest USA, 2007 page 113). This house contains not only real technology, but also systems imagined as being practically available, such as exercise bicycles that generate electricity for use in the house when the residents feel like a workout. The drawings of this house do not actually make it look like a masterpiece of contemporary architecture, yet when the goal is to be as energy efficient and environmentally responsible as possible, it is likely that standards of aesthetics will evolve as well, placing emphasis on features that, it is hoped, will ultimately "save" the planet.

5
*Diller Scofidio + Renfro, Phantom House, Southwest USA, 2007*

6
*Rafael de La-Hoz, Telefónica District C, Las Tablas, Madrid, Spain, 2002–07*

7
*Rural Studio, Christine's House, Mason's Bend, Alabama, USA, 2005–06*

7

## BIG IS BEAUTIFUL

Although small or even virtual zero-emission houses are interesting exercises for architects with time on their hands or clients with money to burn, large buildings would seem to be a more appropriate target for those who really want to make a difference by reducing their $CO_2$ footprint. The Spanish architect Rafael de La-Hoz has taken an interesting approach with his new Telefónica District C (Las Tablas, Madrid, Spain, 2002–07 page 213) buildings for Telefónica de España SA. This complex for the largest Spanish company measures no less than 390 000 square meters. With a site covering 19 hectares, this is one of the largest corporate projects undertaken recently in Europe. Passive energy strategies play an important role in the design, with high, elegant canopies shading large parts of the buildings. The architect has also used an unusual system of glass fins that project out, at right angles to the façades, creating not only further shade, but also varying shadow patterns on the buildings—giving the impression that their geometric design actually changes all day long, while also generating further protection from the hot Madrid sun. Silk-screened dots of density determined by the angle of exposure to the sun cover the large glazed panel façades and also reduce solar gain while giving a pleasant, slightly tinted effect when viewed from the interior Solar panels cover 26 000 square meters of the top of the canopy, transforming enough solar energy into electricity to prevent 2000 tons of $CO_2$ from being emitted into the atmosphere each year. A garden (not designed by the architect) links the buildings and adds an element of green to the otherwise spacious and airy complex. It is undoubtedly a sign that "green" architecture has finally reached the mainstream when a client like Telefónica becomes conscious of the need to address issues of sustainability. This may be all the more important in a hot climate like that of Madrid, where air conditioning costs can be substantially reduced by an appropriate design. In the case of Rafael de La-Hoz, the client has chosen an architect capable of bringing together sustainable features on a large scale and a high quality of architectural design.

In another, even hotter region with great ambitions in the area of architecture, Adrian Smith and Gordon Gill have designed a new headquarters for Masdar (Abu Dhabi, UAE, 2008–10, page 327). Part of "the world's first zero-carbon, zero-waste city fully powered by renewable energy," the building naturally has a large roof canopy covered with photovoltaics, but it also employs wind turbines and cones to harness another form of natural power Water and energy use are carefully controlled, while "sustainable materials are utilized throughout and were selected based on life-cycle analysis." At 88 000 square meters, the Masdar Headquarters makes green look sexy, if a little big. Adrian Smith is known in the region as the designer of a number of other large structures, and in particular the world's tallest building, the Burj Dubai (SOM). He and other "star" architects like Lord Norman Foster, who is also involved in the Masdar City initiative, are beginning to prove that sustainability can be something other than a boring set of calculations—it can be genuinely exciting when architecture is not simply an elaborate support for photovoltaic cells covering endless flat roofs.

Norman Foster completed an entire campus in the jungle of Malaysia about four years ago (Petronas University of Technology, Seri Iskandar Malaysia, 1999–2004, page 147). With a 450-hectare site and gross floor area of 240 000 square meters, this is assuredly a large project, intended for approximately 6000 students. Built into the topography of the site, the buildings have numerous canopies that serve both to shelter from the sun and from frequent rains in the monsoon season. Carefully thought out to encourage social interaction, and executed

8

*8*
*Adjaye Associates, Museum of Contemporary Art/Denver, Denver, Colorado, USA, 2004–07*

with the modern rigor that is typical of Foster's office, the Petronas University shows that appropriate design depends in some circumstances as much on climate as it does on clever technology. Foster was, of course, one of the pioneers among better-known architects in adapting to the need to make buildings sustainable; he, unlike some other "star" architects, can thus surely not be accused of "jumping on the green bandwagon" at a late date.

Masdar City (meaning "the source") is meant to rely entirely on solar energy and other sustainable energy sources. It will be built near Abu Dhabi International Airport and, although it is being designed by Foster + Partners, architecture will certainly not be its only original aspect. Such large firms as BP Royal Dutch Shell, Mitsubishi, Rolls-Royce, Total S. A. Mitsui, and Fiat are grouped together in an initiative dubbed the "Clean Tech Fund," while plans are underway to build a 40 to 60 megawatt solar power plant, wind farms, a hydrogen power plant, and geothermal energy sources. Other initiatives of this type have been announced in the Middle East and in China, which leads to the thought that architecture itself may well be obliged to change if the green wave gets any bigger. Clearly, a number of the most famous architects have relied on their solid aesthetic sense to leave their mark in the past. Huge projects like Masdar and even the GBC LEED rating system necessarily spread the responsibility for sustainability to all of the professions involved in building and beyond, as well as the need to search for and use new technologies that are more related to electrical engineering, for example, than they are to the more traditional sorts of construction engineering. "Good" architects and even some great ones have long been accustomed to using the best and sometimes most expensive materials available, without much concern about where they come from or if their sources are renewable. At the other end of the scale, the great majority of buildings are realized under increasingly money-driven conditions that lead in the worst of circumstances to the kinds of buildings that have absolutely no hope of withstanding an earthquake, for example. The drive for sustainability implies slightly different calculations about cost, perhaps admitting for the first time in several decades that immediate price is not the only way to judge the performance of architecture. Green architecture also implies an increasingly interconnected web of participants in the building process, perhaps in some cases reducing the freedom of action of the architect. The point of this book is to show that "good" architecture and sustainability can indeed go hand in hand, especially if the definition of "green" is a fairly broad one.

## PLATINUM DREAMS

The LEED rating system addresses six major categories of questions in establishing its ratings: these are essentially judgments concerning sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and, finally, innovation and design process. There are four LEED ratings, which are determined on a basis of a total number of points, with 69 being the maximum where new construction or major renovations of commercial buildings are at issue. The ratings are Certified (26–32 points); Silver (33–38 points); Gold (39–51 points); and, finally, Platinum (52–69 points).

The Grand Rapids Art Museum (Grand Rapids, Michigan, USA, 2004–07 page 395) was designed by wHY Architecture, a firm founded in 2003 by Yo-ichiro Hakomori and Kulapat Yantrasast. Yantrasast worked before 2003 in the office of Tadao Ando, collaborating on such projects as the Fort Worth Museum of Modern Art. The Michigan Museum is an interesting case in point because a major donor for the proj-

9

*9*
*Michael B. Lehrer, Water + Life Museums Campus, Hemet, California, USA, 2001–06*

ect, local philanthropist Peter Wege, made obtaining a LEED certification a condition for giving money to the new project. With 10% of its construction materials recycled and extensive use of natural light or reuse of rainwater the new structure is both intelligent in terms of sustainability and also boasts a strong, minimalist design that does bring to mind Yantrasast's previous working experience.

Although smaller in size, David Adjaye's first public commission in the United States, the Museum of Contemporary Art/Denver (Denver, Colorado, USA, 2004–07 page 49), became the first museum to attain a LEED Gold rating. Low energy consumption, low greenhouse gas emissions, and the use of environmentally appropriate raw materials contributed to this rating. Adjaye, of course, has a considerable reputation in the United Kingdom, and his arrival in the United States for this project has been a closely watched event. Again, the combination of considerable design skills with an obvious concern for environmental issues proves that green is no longer the ugly duckling of contemporary architecture. Adjaye, though younger than Ando or Piano, for example, is certainly one of the rising stars of world architecture and his very visible participation in the movement toward sustainability is likely to influence many others.

With the likes of Piano (California Academy of Sciences, page 277) and Adjaye "competing" against him to achieve the highest possible LEED rating for a museum, the accomplishment of the Los Angeles architect Michael B. Lehrer, author of the Water + Life Museums complex in Hemet, mentioned above (page 219), is worthy of note. His was the first such structure to obtain a Platinum rating. Intended as a "living example of sustainability and conservation," the Water + Life Museum has a 3000-panel solar array that provides 50% of energy needs, and a water reclamation system for drip irrigation of plants. Abundant natural daylight and extensive use of heat-blocking glass are other features of the structure. Lehrer is surely not as well known as Adjaye, but his powerful design for the Hemet Museum, coupled with the Platinum rating, is likely to earn considerable renown.

## CHASING BUTTERFLIES

Although a great deal of defining what green design means has to do with enumerating the different ways that this question is approached by architects or landscape architects, for example, it is also about thinking out the consequences of the built environment for sustainability. Sustainability, too, can be defined in various ways. Should a forest grow back after it is cut? Or should the entire rhythm of human existence on the planet condemn the species, or, indeed, most life on earth, within relatively brief time spans on a geological scale? The answer to the first question depends on how trees are cut and how they are replanted. The second one verges on the philosophical since accurate measurements of remaining resources, global warming, or the progressive extinction of species are the subject of active debate amongst scientists, let alone politicians. There does seem to be growing evidence of global warming, the extinction of certain species, and the depletion of reserves, such as that of petroleum. The very mechanisms that lead to ecological catastrophe are not well understood, surely because of the systemic interdependence of life on earth, but also because of the inaccuracy of weather predictions and analyses of the consequences of given actions.

Despite the existence of the LEED standards, sustainability is not a cut and dried affair The famous "butterfly effect" seen in chaos theory surely applies to changes in the climate. What seems to be a positive approach on a local scale might well have a greater negative

10

*10*
*Barlindhaug Consult AS, Svalbard Global Seed Vault, Longyearbyen, Svalbard, Norway, 2007–08*

impact than anyone suspects. Accounting for the real environmental costs of manufacturing photovoltaic cells or biofuels is not a simple affair, as recent news items have shown. Rising costs of certain materials lead to economic adjustments that may obviate carefully calculated gains. When it is cheaper to ship granite from Zimbabwe than to use local stone, are architects and promoters really to blame if their materials come from the other side of the planet?

It seems clear that one consequence of the "green revolution" is that individuals are encouraged to feel responsible not only for their fate by that of others, but also for other life forms. Obviously used to building as they please, some architects are now finding themselves lifting their buildings off the ground in order to reduce their impact not only on the land itself but also on the various types of plant, animal, or insect life that abounds there. Even the LEED system is not inclusive enough where this logic is concerned. However, a holistic approach that might consider architecture to be part and parcel of the natural world rather than an alien presence imposed by the force of machines is in the cards, perhaps many years off or perhaps closer than some believe. The young New Zealand architect Chris Tate built his own house (Forest House, Titirangi, Auckland, New Zealand, 2006, page 357) in a protected natural environment. Though inspired by Philip Johnson's splendidly isolated Glass House, Tate's design takes into account all local zoning and environmental restrictions and allows itself to be almost swallowed up by nature. Sustainability, indeed, does not necessarily mean living in a building that smells like hemp or has walls made of rammed earth even though those options exist as well.

## FROM BABYLON TO THE ARCTIC

The extreme range of "green" projects that exist today might be symbolized by the selection of three works in this book, one built and two unbuilt. One unbuilt work is by the French team Agence Babylone. Their Active Nature proposal (Saclay, France, 2007 page 55) was the result of a competition launched by a group of 49 townships in the area of Paris. Although it is unlikely to be built in its proposed form, their idea consists in making radical use of the "productive capacities of nature," while preserving as much farmland as possible given predicted increases in population. Interesting because it is a combined scheme (in collaboration with architects SoA), this landscape and architecture design might well be the most reasonable path to the future, assuming the capacity of townships to impose an overall plan despite the extensive commercial interests involved. Mixing architecture and landscape design, futuristic green technology and a degree of clever presentation, the Active Nature project points, too, at the increasingly necessary collaboration between disciplines, especially when dealing with phenomena that are global rather than local. Indeed, the fact that global factors are now impinging on matters that used to be of strictly local concern is one of the very significant changes facing architecture as the "green revolution" takes hold.

The Belgian architect Vincent Callebaut takes a similarly "utopian" view of a green future. His Anti-Smog design for Paris (France, 2007 page 95) would make use of "all available renewable energy forms to fight against the Parisian smog." This would include windpower, phyto purification of water, photovoltaic cells, and a coating of smog-eating titanium dioxide ($TiO_2$) for good measure. When large numbers of new technologies are used in single projects, one may legitimately wonder if they are likely to work as well as hoped. There is something of the clever "gadget" about such architecture as well, and yet the imminent arrival of buildings whose real purpose is to fight pollution may not

11
*SITE, Fondazione Pietro Rossini Pavilion, Briosco, Italy, 2000–08*

be too far off. Callebaut takes a sci-fi approach to his concepts, which, of course, means that they are not entirely serious. These are "what if" projects that may make people think about the ways in which architecture can contribute not only to reducing the pollution it produces directly, but also possibly helping to reduce overall levels of poisonous gases and other dangerous substances in the environment.

The third recent project that illustrates a very different way to approach climate change is the Svalbard Global Seed Vault (Longyearbyen, Svalbard, Norway, 2007–08, page 77) by Peter Søderman of Barlindhaug Consult AS. Essentially a long tunnel and vault carved into a frozen mountain in Norway's Arctic north, this facility is designed to save the diversity of the world's seeds no matter what ecological or military crisis might cross the planet in the years to come. Though it is graced with a glittering work of art by Dyveke Sanne, the Svalbard Global Seed Vault has something of the Doomsday Machine about it—an icy vault that awaits a catastrophe that may well have already been announced. It is not certain that the GBC would grant this facility a platinum rating, but it is hard to imagine a more ecological or "green" gesture in architecture. This building is a pure expression of sustainability—or a guarantee that crop diversity can be protected even as the waters rise and storms roll over the lands.

## THE TIMES, THEY ARE A-CHANGIN'

The Malaysian architect Ken Yeang is one of the most committed international professionals in the area of sustainable design. His work in this area consists of very real buildings (see his Mewah Oils Headquarters of 2001–03 in Malaysia, page 401 and his New National Library Board Building in Singapore of 2001–05, page 404), but also of considerable thought and writing. In an essay entitled "What is Green Design?" Yeang states: "If we integrate our business processes and design and everything we do or make in our built environment (which by definition consists of our buildings, facilities, infrastructure, products, refrigerators, toys, etc.) with the natural environment in a seamless and benign way, there will be no environmental problems whatsoever." Ken Yeang is clearly pleading for something much broader than a few photovoltaic cells on a roof—he is making the case for a very specific kind of return to nature, where architecture has often sought to challenge nature. "Ecosystems have no waste," continues Yeang, "everything is recycled within. Thus by imitating this, our built environment will produce no wastes. All emissions and products are continuously reused, recycled within and eventually reintegrated with the natural environment, in tandem with efficient uses of energy and material resources. Designing to imitate ecosystems is ecomimesis. This is the fundamental premise of ecodesign. Our built environment must imitate ecosystems in all respects."[8]

One of Yeang's pet ideas over the years has been to bring nature into cities and buildings. Without going as far as his scheme for generalized ecomimesis, it can be admitted that his analysis of the organic and inorganic components of architecture is sensible and could lead to effective changes, short of turning cities into gurgling swamps of biological activity. "Our myriad of construction, manufacturing and other activities are, in effect, making the biosphere more and more inorganic," says Yeang. "To continue without balancing the biotic content means simply adding to the biosphere's artificiality, thereby making it increasingly more and more inorganic, exacerbating this and other environmentally destructive acts such as deforestation and pollution. This results in the biological simplification of the biosphere and the reduction of its complexity and diversity."[9]

12

*12*
*Ken Yeang, Mewah Oils Headquarters, Pulau Indah Park, Port Klang, Selangor, Malaysia, 2001–03*

James Wines of the American group SITE has long had a somewhat bittersweet, or some might say "romantic," vision of nature, designing his early BEST stores in the form of ruins overtaken by a resurgent forest. This idea of nature in architecture seems to be at the heart of his recent proposal, Streetscape in a New World (Beijing, China, 2008, page 324). Here, his drawings depict an increasingly dense web of branch-like paths and intersecting forest areas in the midst of a large urban development. It is, he says, "intended as a metaphor for a growing culture and proposal for environmental improvement in a rapidly burgeoning city." This approach is both a literal one, bringing large trees into the planned complex, but also a poetic one, returning a mixture of concrete and living plants to an environment that is increasingly deprived of anything green.

Although Yeang's program is ambitious, he is getting to the heart of the matter Might it be that green architecture is not so much about architecture as it is about survival? The aesthetics and internal quarreling of the architectural profession are obviously secondary considerations when it comes to finally stopping the war with nature that has resulted in the creation of "the asphalt jungle."[10] The problem, as Yeang points out, is not specific to architecture: it is systemic and concerns industry as much, if not more, than buildings. It concerns life habits and the use of resources, and the need for change before catastrophe ensues. Making green design fashionable is one tool at the disposition of architects, but it seems clear that it is now time, not to jump on the bandwagon, but to face the inevitable. With soaring gasoline prices and so much evidence of climate change, it is likely that the trend to green will be a lasting one. Architects who ignore this trend might just find they have been replaced by clever builders with a bold LEED AP stamped on their visiting card. Then again, good architecture never represented more than a small proportion of what is built in the world. The times, they are a-changin'

*Philip Jodidio, Grimentz, June 29, 2008*

1 "SmartMarket Trends Report, McGraw-Hill Construction Analytics, 2008.
2 "EIA Annual Energy Review 2005, US Energy Information Administration, US Department of Energy.
3 Lenssen and Roodman, "Worldwatch Paper 124: A Building Revolution: How Ecology and Health Concerns are Transforming Construction, Worldwatch Institute, 1995. This reference, as well as the previous two, was noted in "Green Building Facts, published by the US Green Building Council (USGBC), June 2008.
4 Felicity Barringer, "The New Trophy Home, Small and Ecological, in: *The New York Times*, June 22, 2008.
5 Ibid.
6 Ibid.
7 "Reflections on Underground Space, in: *L'Architecture d'aujourd'hui*, May–June 2003.
8 Ken Yeang, "What is Green Design?" in: *Design Does Matter*, Teknion, Mt Laurel, New Jersey, 2005.
9 Ibid.
10 *The Asphalt Jungle* is a 1950 film directed by John Huston, starring Sterling Hayden and Marilyn Monroe.