Reduce to the max

German engineer Werner Sobek is a specialist for lightweight construction and he is a man of reason. Rational thinking demands that one sees exactly how much energy and material a building consumes throughout its lifecycle – because savings in one place can often lead to significant costs in another.

The construction industry has a great task ahead if the world is to be saved from suffocation. Construction consumes not only half our natural energy resources; it produces half the world's waste. "It's obvious," deduced Werner Sobek: "we must reduce the amount of material we use for buildings."

Many of Sobek's projects illustrate new approaches to material use because he is a specialist for lightweight materials, lightweight structures, and lightweight systems. Lightweight materials provide the greatest strength for the least weight. Lightweight structures are ultra-light static frames and envelopes. Lightweight systems deal with functional aspects; an airplane wing, for example, must be at once light, strong, and flexible – and provide space for fuel tanks.

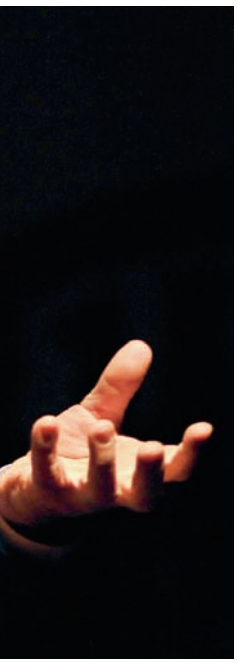
Sobek presented two examples of lightweight systems. The first is a project called "La couverture des Arènes," located in Nîmes, southern France, a project he completed shortly after he graduated. The roof over the Roman arena is a pneumatic structure, 16 meters wide by 90 meters long. The membrane is only one millimeter thick, yet the structure reliably withstands strong local winds. The second example is the German Post center in Bonn; the arch-and-rib structure minimizes weight and maximizes multifunctional space.

"If we talk about resources and resource consumption, it's quite obvious that we have to reduce the amount of material we use in buildings."

Werner Sobek advocates a philosophy of reduction. He calls for lower consumption of materials and fossil fuels – and less attachment to old ways.

"The other way is to build as light as possible, reduce gray energy as much as possible, minimize energy consumption over the entire lifetime, and have a close look at what's left over."

Besides frugal use of resources, recycling is another way to reduce waste. In the construction industry, recycling is a thorny challenge. It takes great effort to reuse many of the materials that go into buildings because they are typically bonded or fixed to other materials and thus difficult to separate. The German automobile industry is mastering this problem. The carmakers' recycling rate is a good 85 percent; Mercedes Benz sometimes achieves even 95 percent. New technologies could help also the building industry achieve higher



“We must go beyond traditional building techniques. We have to look a bit to the left and right.”

recycling rates, “but to do it, one must choose alternative construction methods,” told Sobek. Magnetic, hook-and-loop, and socket connections are potential approaches.

As an example of a completely recyclable building, Werner Sobek presented a newly erected structure: the protective envelope for Station Z, a commemorative site on the grounds of the former concentration camp in Sachsenhausen, Germany. The free-span steel-frame structure is covered with a total of 500 kilograms of textile, stabilized by simple air pressure, regulated by a small pump. Sobek explained the unusual design: “We sought new approaches and building methods that would allow us to build in such a way that later everything can be easily dismantled and removed.” Today we really don’t know what the generations of tomorrow will need or find attractive, said Sobek, “so the buildings we build today must be able to be removed in a good way tomorrow.” Sobek also knows, however: “Of course the issue is sustainability, but it is always a question of beauty too – because without breathtaking beauty people would never accept sustainable buildings.”

Werner Sobek names energy management as another important challenge for the construction industry: “By linear extrapolation, our natural oil resources will last perhaps another 25 years. You don’t have to be a scientist to figure out that this will cause more than a catastrophe.” And linear extrapolation is overly optimistic anyway,

because mankind is consuming increasingly more oil. Thus the declared intention must be to massively curb energy consumption, "also because we have far better things to do with oil than burning it; we need it to manufacture pharmaceuticals, plastics, and much more."

"I think we as architects and engineers are not in the position to predict what future generations will need and love. So the buildings we design today should be able to be removed in a good way tomorrow – and that means one hundred percent recyclability."

Sobek is critical of saving energy by wrapping buildings in thicker and thicker insulation: "You have to compare the energy you save by using thicker insulation with the energy you expend to build up the insulation layer. Sometimes we completely ignore gray energy." It makes much more sense to build the structure lighter and place the insulation within the structure itself – for instance, using blocks with cavities that can be filled with insulating foam.

The airtight super-insulated house with life-sustaining ventilation machinery is in Sobek's eyes also an unappealing prospect: "I don't want to live in something like that; it makes one depressive." He pleads rather for "active buildings," buildings that collect all forms of energy that nature delivers free to the doorstep – and then use the energy directly. As an example, the engineer cited "La Cité du Design"

“Sustainability in architecture will not be broadly accepted unless it offers breathtaking beauty.”

in St. Etienne. The gigantic multifunctional space is enclosed by an outer skin comprising 14,000 triangular elements that perform special functions. They not only protect the building against wind, water, and the heat of the sun; they generate energy. “Such technologies, combined with lightweight construction methods, point in the right direction,” said Sobek. “And this path is absolutely feasible!”

Werner Sobek is Principal of Werner Sobek GmbH and Director of the Institute for Lightweight Structures and Conceptual Design (ILEK), University of Stuttgart, Germany. ILEK specializes in the research of new materials and new concepts for lightweight and adaptive structures. Werner Sobek GmbH focuses on the design of construction elements and concepts for sustainable buildings including special structures in steel, glass, titanium, concrete, textiles, and wood. He has received the DuPont Benedictus Award, European Gluelam Award, Fritz Schumacher Award, iF Design Award, SEAOI Structural Engineering Award, AIA Awards, Hugo Haering Award, Fazlur Rahman Khan Medal, and the UIA’s Auguste Perret Prize. Werner Sobek has been nominated as a Member of the jury of the Global Holcim Awards 2012.