PROFILE

Stefan Lehnert (left) and Ben Morris of Vector Foiltec.

The future's in the skies

For 25 years Ben Morris and Stefan Lehnert of Vector Foiltec have been filling the world's roof line with ETFE. Now green innovation is helping open up the technology to wider uses, writes **Elaine Knutt**

Portrait by Ed Tyler

Job interviews for prospective employees of Vector Foiltec, the innovative specialist supplier that gave the architectural world the ETFE envelope, tend to proceed along slightly unusual lines. Co-founder Ben Morris, who started his career as an architect at Sheppard Robson, has perfected his line of questioning. "Do you know how to put shelves up? Do you know how to work with tools?" he asks. And if he's satisfied with the answers, he'll pose the clincher. "Do you go sailing?"

Looking round the company's Brick Lane headquarters, the relevance of the first two questions is obvious. It's an overgrown garden shed of an office, with homemade shelves filled with bits of prototypes and profiles jostling for space with cardboard models of frames and trusses.

"If we want to see if something works, we mock it up," says Morris.

The sailing reference acknowledges the nautical origins of the company. Twenty-five years ago co-founder Stefan Lehnert used his dual expertise in engineering and ocean racing to achieve the key technical breakthrough: finding a way to weld ETFE foil to itself, and developing a fixing system that would be as long-lasting as the foil itself, a polymer previously used in experimental sail technology that could be used on an architectural scale.

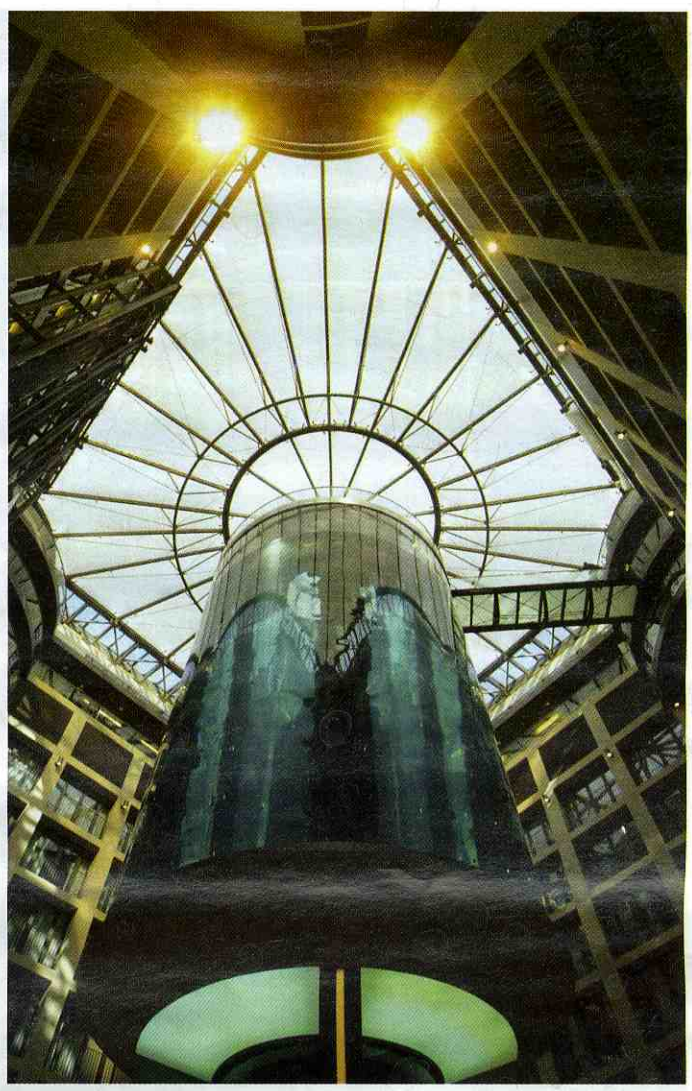

The ETFE atrium at Swinburne University, Melbourne, Australia.

'Ben is a talented architect and designer, and I represent the engineering and installation side — the down-to-earth stuff'

The two partners are still keen sailors, Lehnert a former three-time winner of the Admiral's Cup in the Solent, off the Isle of Wight. So the question also references an attitude in the company because — just as in sailing — designing lightweight structures at the edge of engineering tolerances is about taking calculated risks and having a gut feel for loadings and tolerances, as much as it is about IT power.

The recruitment policy must also have worked. Vector Foiltec

ABK Architects' John Wheatley College is the first project to use laminated PV cells in ETFE.



An ETFE roof sits above the world's largest saltwater aquarium in Berlin's DomAquaree, a hotel by architect NPS Tchoban Voss.

now has 10 offices worldwide, more than 300 staff, turnover of an average of £30 million, and is responsible for 95% of ETFE installations worldwide, with around 30 projects on site in the UK.

"We have some of the best brains in the world's lightweight engineering industry," says Morris. And the Anglo-German partnership has been a success too.

"In any partnership each partner should bring something different. Ben is a talented architect and designer, and I represent the engineering, manufacturing and installation side of the company — the down-to-earth stuff," says Lehnert.

"We trust each other absolutely. If I make a decision, Stefan lives with it, and vice versa," adds Morris.

Retro and futuristic

Translucent ETFE cushions, held within aluminium boundary frames and inflated at low air pressure to improve insulation and load capacity, have freed up architects to think differently about buildings. Spanning large distances, facilitating double-curving and organic shapes, and turning covered external space into weatherproof envelopes, it has been adopted enthusiastically by innovators such as Rem Koolhaas, Herzog and de Meuron, and Foster & Partners. It's both retro and futuristic, a material that fulfils the conceptual designs of Archigram and Frei Otto, and points the way ahead to building envelopes that incorporate their own intelligent, responsive systems.

"If you embrace the materials, philosophy and ideology of the technology and understand it, you have huge opportunities," says Morris. "Louis Kahn said, 'Listen to the brick.' Vector Foiltec says, 'Listen to the plastic bag!'"

The plastic bag certainly has ambitions. Since the first project — the 1982 Mangrove House at Arnhem Zoo, where the original ETFE roof is still in place and showing no sign of UV degradation after 25 years — ETFE roofed the atrium at Sheppard Robson's innovative Chelsea & Westminster Hospital in London, then gave the world the fulfilment of Buckminster Fuller's biodomes at Grimshaw's Eden Centre in Cornwall.

Kingsdale School in south London demonstrated a new twist in the technology, where different layers in the ETFE cushions were printed with graphics. As the layers interact, it is possible to alter the amount of light and solar energy entering the space.

The firm's latest innovation is a climatic envelope, a step into a sci-fi world of alternative ecosystems. At the Foster & Partners' Entertainment Centre in Kazakhstan, Vector Foiltec is creating an ETFE pavilion supported by a 200m-high mast. On the cold Kazakh steppe the highly insulating ETFE maximises heat and energy penentration to shelter 10,000sq m of entertainment facilities.

In Beijing Vector is creating another climatic envelope around four towers that will protect it from sandstorms, pollution, cold and heat. "You're taking the extremes of hot and cold away, and you're left with a temperate middle zone," says Morris.

But before that the next project to demonstrate the dramatic potential of ETFE will be the Beijing Water Cube, aka the Olympic Aquatics Centre, by Australia's Sydney-based PTW Architects. Reaching completion in October, it is the largest ETFE-clad structure in the world, with over 100,000sq m of ETFE pillows. In PTW and Arup's design, structure and facade are one and the same element.

Vector Foiltec has continued along the path of innovation it set off on 25 years ago. It has perfected a smoke-venting system for ETFE roofs, where a "hot wire" carrying a current linked to an alarm cuts the foil and lets it drop down, allowing the internal space to be redefined as external, with accompanying savings on means of escape and fire protection.

It has also patented a method of laminating PV cells into ETFE, and has built the first project using the technology, the John Wheatley College in Glasgow by ABK Architects. If enough energy is generated, the surplus could be sold, turning the roof into a solar energy farm.

'People are working towards zero energy, but we're working towards a positive energy envelope'

"People are working towards the zero-energy envelope, but we're working towards the positive energy envelope," Morris asserts.

Sustainably green

It's an example of ETFE use that can fit neatly into the green agenda. By exploiting the lightness of the technology, Morris estimates that a third of the support structure, whether steel or timber, is required, compared to other cladding technologies.

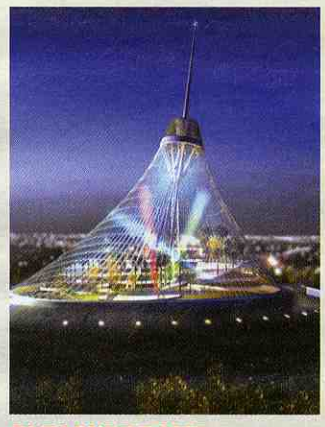
Designing with ETFE can therefore shrink the building's overall carbon footprint, while the material's own tread on the planet is relatively light. The raw ingredients are the natural mineral, fluorspar, plus ethylene, which can be derived either from the petrochemical industry or plant sources. The two are combined in a "water-based" process.

Sustainably green, lightweight, and futuristic, ETFE sounds like a good fit for the requirements of the large-span sports structures to be built for the London Olympics. Morris says he's "had conversations with the various parties" involved, and Lehnert is equally optimistic that we could be seeing ETFE on the Stratford skyline.

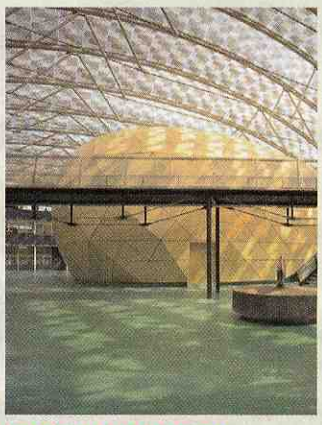
"With big projects, you need wide-span, lightweight structures. There's no other material that gives these requirements together," he says.

VECTOR FOILTEC'S PROJECTS AROUND THE WORLD

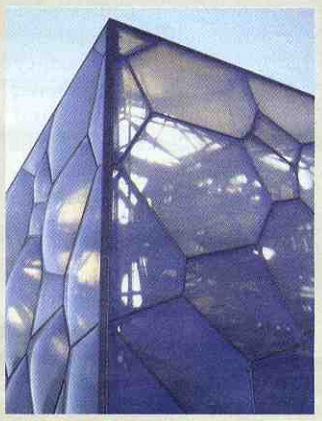
MANGROVE HOUSE
ABT Adviesbureau voor Bouwtechniek
Mangrove House at Arnhem's Burgers' Zoo in the Netherlands was the company's first project, completed in 1982. It claimed to be the only artificial rainforest in the world with no chemical intervention. The original ETFE roof is still in place, and the same client later commissioned a further 2,800sq m of ETFE.



PLEASURE DOME
Foster & Partners
The Khan Shatyry Kazakhstan Entertainment Centre in Astana, Kazakhstan, will sit at the northern end of the new city axis. The idea is to modulate the external temperature, so when the rest of the city is at -30°C, residents can play tennis or sit at pavement cafes. The yurt-like envelope will have a viewing gallery at the top of the 200m mast.



KINGSDALE SCHOOL
dRMM
The roof of Kingsdale School in the London Borough of Southwark, which was refurbished by dRMM in 2004, consists of 3,200sq m of triple-layered ETFE cushions screenprinted with a unique pattern. As the cushions are inflated to improve insulation or deflated in warm weather, the patterned surfaces work together to reduce or maximise solar gain.



WATER CUBE
PTW Architects
Conceptually the Beijing Water Cube's square box and interior spaces are carved out of an undefined cluster of foam bubbles, symbolising a "cube of water molecules". The random appearance of the ETFE cushions hides a strict geometry found in natural systems such as crystals, cells and molecular structures.