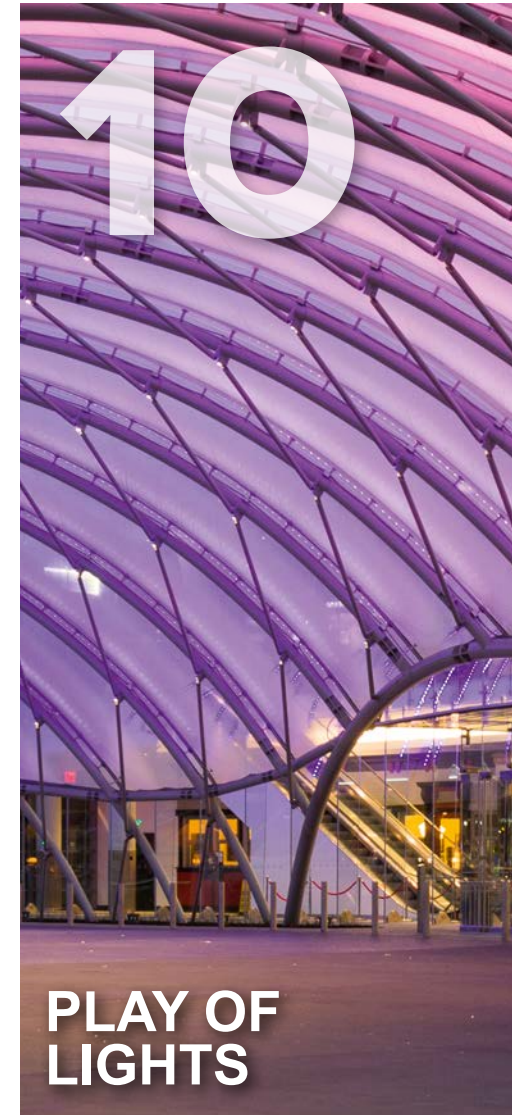
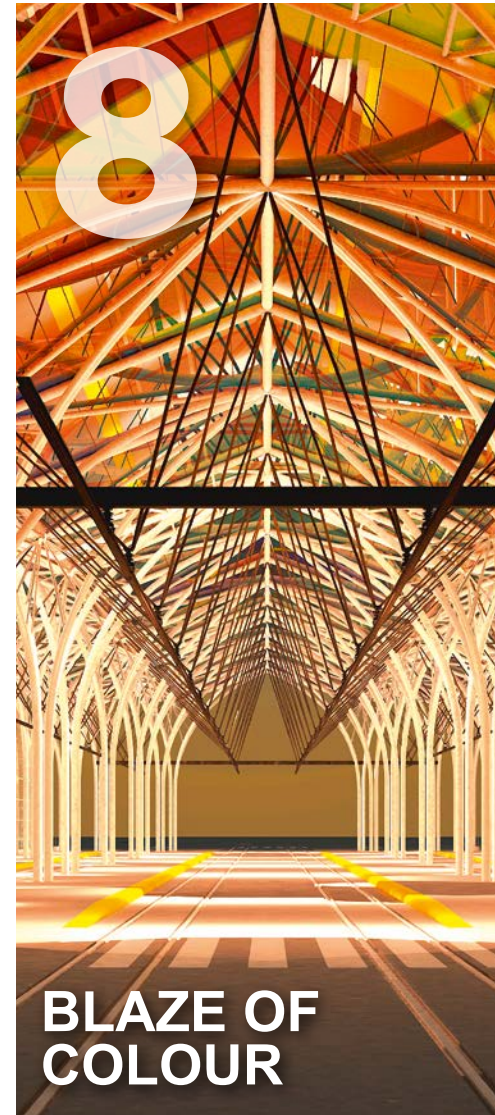


Taiyo Europe
Mak//ax

**TRANSPARENT
AESTHETICS WITH ETFE**



ENGLISH



Yonkers Raceway Casino | Visitors of the Yonkers Raceway Casino are welcomed by a 60 m long, transparent curved roof. The sculpture-like design protects against the elements. At night the spectacular illumination of the ETFE roof brings the atmosphere of Las Vegas to Yonkers, New York.

Year of construction: 2013; Architect: Studio V Architecture, New York, USA; Engineering: DeSimone Consulting Engineers, New York, USA; FTL, New York, USA; construct AG, Rosenheim, Germany; Material: dual-layer ETFE thin film; Location: Yonkers, New York, USA.

THE FAVOURITE MEMBRANE MATERIAL

Thin films made out of ethylene tetrafluoro-ethylene – short form: ETFE – are extremely transparent, durable, printable and illuminable. That's why they are a perfect choice for membrane construction.

Thanks to their low inherent weight and elegance they speak a distinct architectural language: atria flooded with light, a nature-like climate, delicate construction – all this with highest resistance against UV rays and weather effects.

And thanks to its properties and its durability in almost every climate, ETFE has been a proven choice for many decades.

Soundscapes – an interactive construction Motion sensors in a house of cards made of ETFE cushions	4
Broad perspectives – aesthetics and sustainability A combination of an ETFE roof and photovoltaic cells	6
Blaze of colour – the many colours of ETFE Colour printing of a single-layer thin film	8
Play of lights – staging at night Illumination of facades and roofs	10
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Engineering art – the special talents of the ETFE technology Overview of all technical data	14

CONTENT

SOUNDSCAPES



4

**AN INTERACTIVE
CONSTRUCTION**



COCA-COLA BEATBOX

A perfect symbiosis of architecture, sports, music and the latest technologies, this venue was designed as an interactive pavilion for London's Olympic Summer Games.

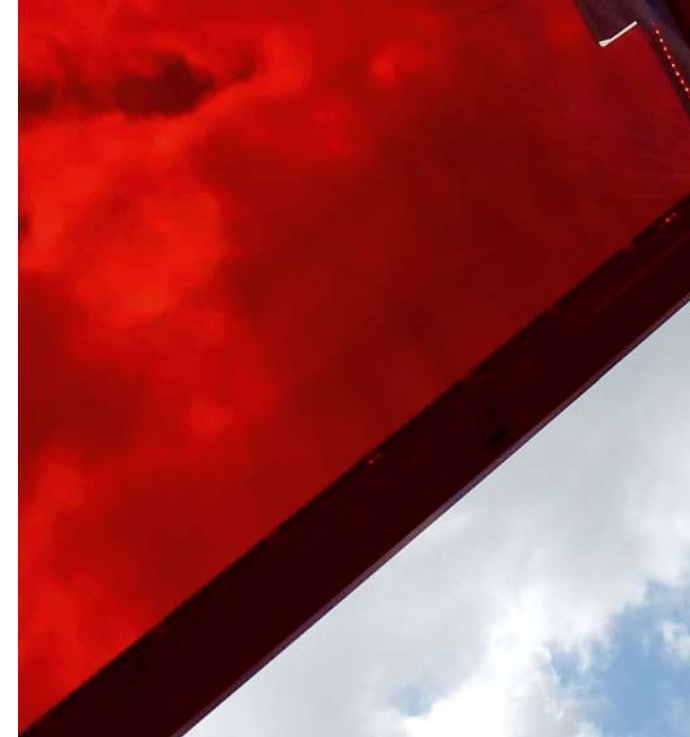
Year of Construction: 2012

Architect: Pernilla Ohrstedt & Asif Khan,
London, UK

Engineering: AKT II, London, UK;
LEICHT, Rosenheim, Germany

Size/Material: 1,560 m²; ETFE, transparent,
dual-layer cushions, LED
illumination, acoustic sensor
technology

Location: Olympic Park London, UK



FLASHING TO THE BEAT

The facade of the Coca-Cola beatbox consists of 230 red and white ETFE cushions. 40 of them, evenly distributed over the facade, are equipped with motion sensors that create sounds when a visitor approaches or touches them.

- ETFE cushions, equipped with interactive technology
- LED illuminated
- house of cards design: each cushion is stabilized by two adjacent cushions
- closed static system with a high level of difficulty



BROAD PERSPECTIVES

6

**AESTHETICS AND
SUSTAINABILITY**



AN INTELLIGENT COMBINATION

Sustainable construction at the highest technological level: the exemplary combination of an ETFE roof and a photovoltaics system. The connection of form and function is highly successful: the plant feeds 97 percent of the generated energy into the public grid. Just 3 percent are needed for the ventilation unit that generates the cushions' supporting air.

- high translucency
- long durability of the thin film
- protection against sunlight through flexible thin-film PV cells and printing
- energy generation
- energy saved through circulating air system

ABFALLWIRTSCHAFTSBETRIEB MÜNCHEN (AWM)

The integrated photovoltaic cells give the roof a high-class ecologically role.

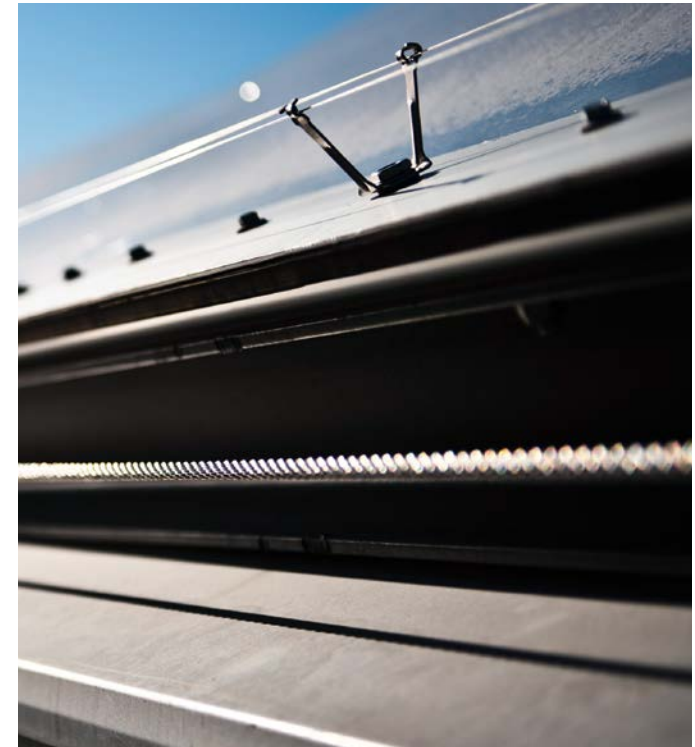
Year of Construction: 2011

Architect: Ackermann und Partner
Architekten BDA, Munich, Germany

Engineering: Ackermann Ingenieure, Munich,
Germany; konstrukt AG,
Rosenheim, Germany

Size/Material: 8,000 m²; ETFE, transparent,
base printed, 220 triple-layer
cushions

Location: Munich, Germany



BLAZE OF COLOUR

8

THE MANY COLOURS OF ETFE



LODZ TRAM STATION

No longer just an idea: this colourful example demonstrates that ETFE has long crossed over from an experimental to an innovative material.

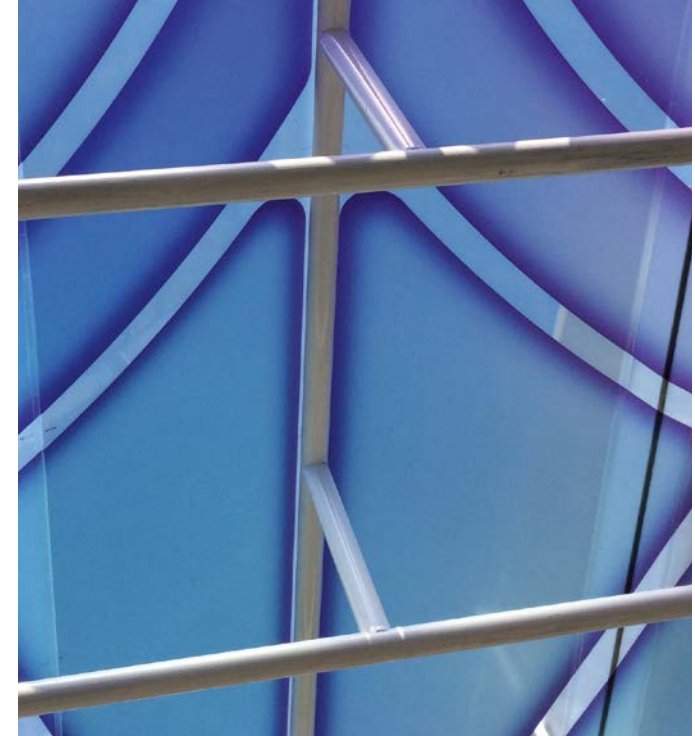
Year of Construction: 2014

Architect: FOROOM sp. z o.o., Warsaw, Poland

Engineering: Buro Happold, Warsaw, Poland; konstrukt AG, Rosenheim, Germany

Size/Material: 4,000 m²; ETFE, colour printed, single-layer

Location: Lodz, Poland

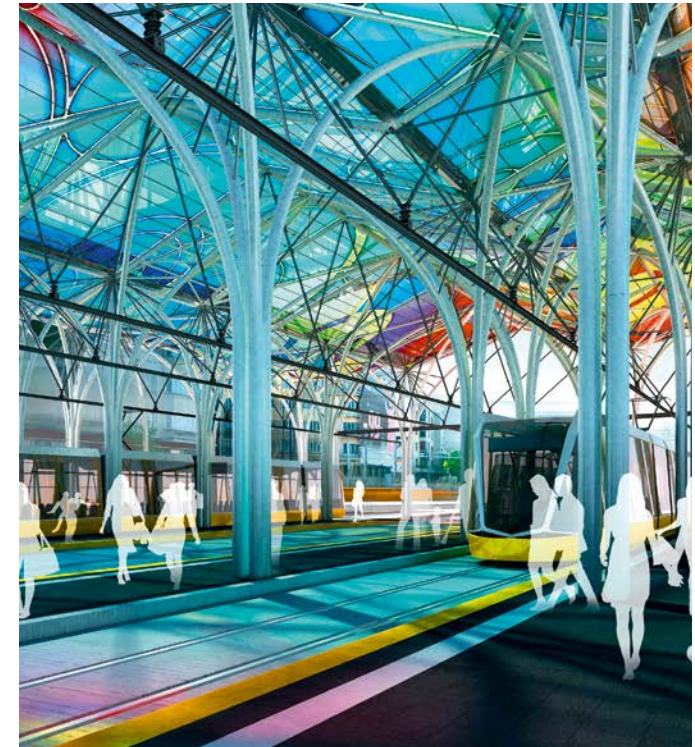


ETFE SHOWS ITS COLOURS

The roof of the Piotrkowska Street tram station in Lodz, Poland, contains a colour printed ETFE cover. A single-layer transparent facade has been added.

Its specialty is its application:

- unique, completely new printing technology
- multi-faceted, non-repeating pattern



SOPHISTICATION AND DESIGN

ETFE and LED: a material and a light innovation that work together in perfect harmony. And that give architects limitless design options.

Coloured and printed, the material is usable for both direct projection and surface illumination. Colour range and transparency are nearly limitless.

YONKERS RACEWAY CASINO

The sculpture-like construction of the ETFE roof brings Las Vegas style illumination to Yonkers, New York.

Year of Construction: 2013

Architect: Studio V Architecture, New York, USA

Engineering: DeSimone Consulting Engineers, New York, USA; FTL, New York, USA; konstrukt AG, Rosenheim, Germany

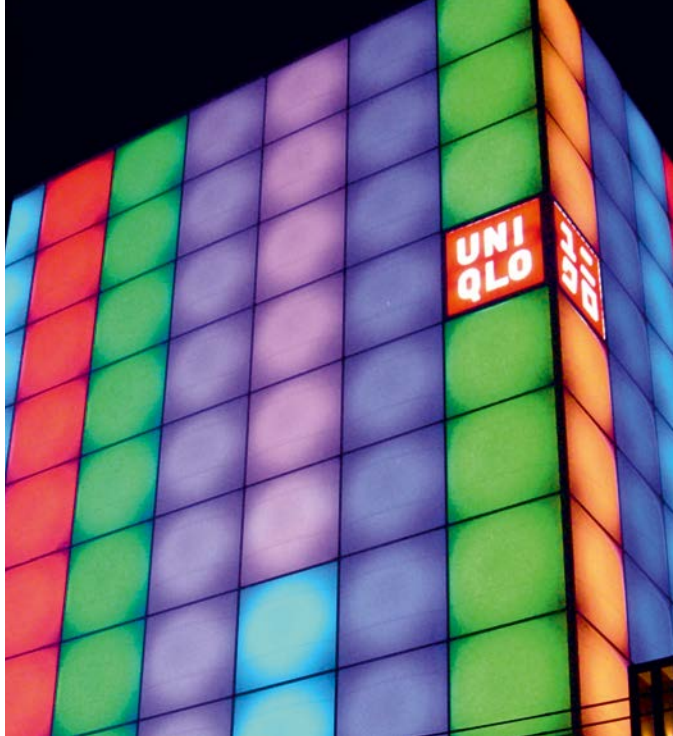
Size/Material: 1,400 m²; ETFE, transparent, dual-layer, LED illuminated

Location: Yonkers, New York, USA

PLAY OF LIGHTS

STAGING AT NIGHT





YAPI KREDI BANKING ACADEMY

The vibrantly coloured Yapi Kredi Banking Academy distinguishes contrasts its facade and roof with elegant architecture and smooth transitions.

Year of Construction: 2010

Architect: TEGET, Istanbul, Turkey

Engineering: Maffeis Engineering S.p.A., Solagna, Italy

Size/Material: 800 m²; ETFE, transparent, silver printed (twice), triple-layer cushions

Location: Istanbul, Turkey



UNIQLO SHINSAIBASHI



A shining example for a moving light staging with ETFE. The 158 cushions are transformed into a projection screen, thanks to LEDs in different colour combinations.

Year of Construction: 2009

Architect: Sou Fujimoto Architects, Tokyo, Japan; Nikken Sekkei LTD., Tokyo, Japan

Engineering: Nikken Sekkei LTD., Tokyo, Japan

Size/Material: 1,200 m²; ETFE, transparent, white, dual-layer, LED illuminated

Location: Osaka, Japan



AQUADROM RUDA ŚLĄSKA



Water, warmth, light and lots of colour: ETFE unites the elements in natural harmony.

Year of Construction: 2012

Architect: Schick & Partner Polska, Ruda Śląska, Poland

Engineering: Maffeis Engineering S.p.A., Solagna, Italy

Size/Material: 1,200 m²; ETFE, transparent, printed, triple-layer, LED illuminated

Location: Ruda Śląska, Poland

SPATIAL VISIONS

12



FROM VENTILATION TO THERMAL INSULATION

WITH STEEL, AIR AND ETFE

Light-weight steel constructions and multi-layer ETFE cushions that can be transformed into a myriad of shapes according to the architect's vision are exciting eyecatchers.

- usable in large temperature ranges
- heat insulating
- low maintenance costs

RIVER CULTURE THEATER PAVILION

The contours of this impressive architectural masterpiece are shaped through air-filled ETFE cushions.

Year of Construction: 2012

Architect: Asymptote, Hani Rashid,
New York, USA

Engineering: Withworks, South Korea;
konstruct AG, Rosenheim,
Germany

Size/Material: 1,990 m²; ETFE, silver printed
(twice), white, black, quadruple-
layer cushions, moiré effect

Location: Daegu, South Korea



L'ORTO BOTANICO DI PADOVA

The high transparency of the ETFE roof is a boon to the plants in Padua's botanical garden.

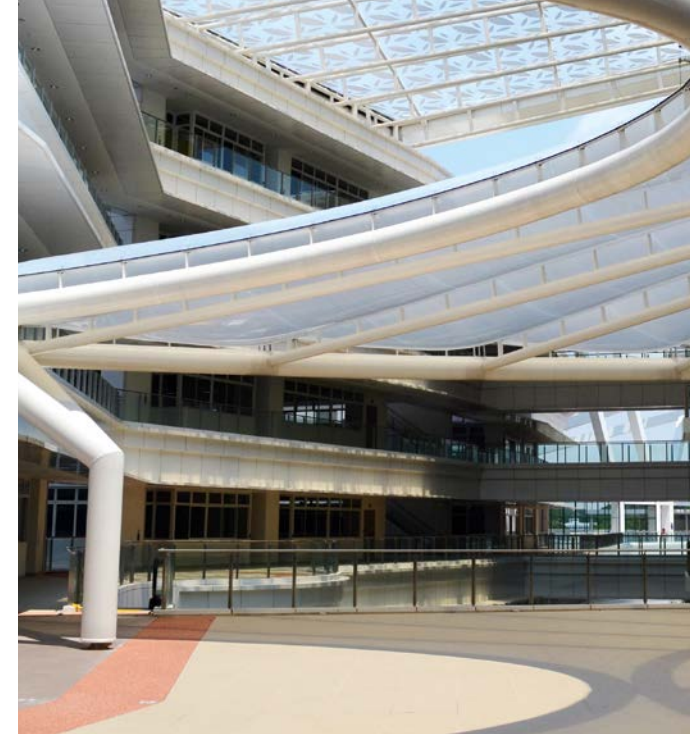
Year of Construction: 2012

Architect: Giorgio Strappazon di VS associati Srl, Marostica (VI), Italy

Engineering: Maffei Engineering S.p.A., Solagna, Italy

Size/Material: 2,300 m²; ETFE, transparent, dual-layer cushions

Location: Padua, Italy



MILAN CENTRAL STATION



Visitors of the gallery in Milan's central station enjoy a pleasant indoor climate even at cold outside temperatures.

Year of Construction: 2013

Architect: Politecnica, Modena, Italy

Engineering: Maffei Engineering S.p.A., Solagna, Italy

Size/Material: 320 m²; ETFE, transparent, single-layer facade, dual-layer cushions

Location: Milan, Italy



INSTITUTE OF TECHNICAL EDUCATION (ITE)



The impressive roof construction consists of six individual single constructions, serves as rain protection and provides lots of shade.

Year of Construction: 2012

Architect: ARUP Architects, London, UK

Engineering: Maffei Engineering S.p.A., Solagna, Italy

Size/Material: 6,000 m²; ETFE, transparent, printed, dual-layer cushions

Location: Singapore, Singapore

ENGINEERING ART

THE SPECIAL TALENTS OF ETFE TECHNOLOGY

Almost no other material is comparable to ETFE – especially if one wants to create constructions that stand out from the rest. Transparent roofs, facades or atria flooded with light: ETFE's areas of application are as diverse as the material itself.

ACOUSTICS

Sounds, tones and noises can pass through ETFE thin films quite well – thanks to their low mass. Sound waves are more likely to be absorbed by the material than reflected. This creates pleasant room acoustics with acoustic insulation values of about 10 dB.

LIGHTNESS

ETFE thin film is a lightweight. Using ETFE minimizes the need for steel and thus leads to cost reduction. ETFE's weighs circa 175 g/m² per 100 µm. Our customers save money for both roofing material and substructure construction.

DIRT RESISTANT

The dirt resistant thin film dispenses with expensive roof cleaning access systems. Deposits are washed away by the rain. As a rule, ETFE roofs require no cleaning.



AIR SUPPLY

Modern air supply systems are equipped with fine particular air filters and air drying systems. The units are individually designed depending on location and project size.



AIRFLOW

Special attention is given to the design and material choice of the air intakes. This includes consideration of each individual project's design and cushion size as well as inlet valve size. When selecting the hose, both transparency and UV resistance are important factors.



TRANSPARENCY

Roofs equipped with ETFE thin film are permeable to both natural light and UV rays. Practically the whole light spectrum passes the material unfiltered and creates a near-natural lighting atmosphere. Guests of a wellness spa could, for example, take a sunbath under a roof equipped with ETFE thin film.

MOUNTING SYSTEMS

Modern mounting systems allow a segment free clamping of the thin film layers. In special cases, we design individual mounting systems.



FIRE BEHAVIOUR

ETFE thin film is flame resistant. This is confirmed by numerous national and international fire safety certificates.



THERMAL INSULATION

U-Value

Using ETFE constructions, the U-Value is influenced by the number of thin film layers and the mounting type. In general, the following building physics U-Values apply:

Thin film layers U-Value*

2	2.9 W/m ² K
3	1.9 W/m ² K
4	1.5 W/m ² K
5	1.2 W/m ² K

* The values above are calculated average values. Normally, U-Values are calculated for each individual project.

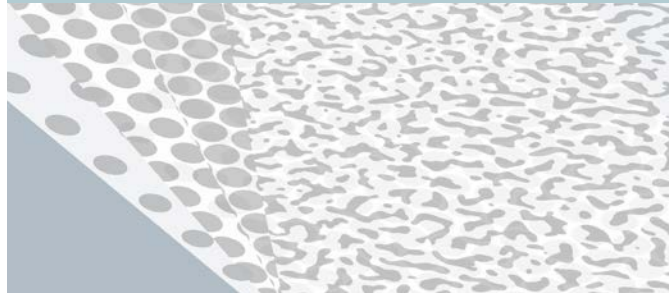
VARIETY OF SHAPES

A plethora of examples show the material's incredible diversity in terms of shape and design that are impossible to realize with any other transparent material.



PRINTING

Printing is a method to modify the translucency and the g-value of the material. In many cases, printing is also used to create projection screens for play of lights. Wherever diversity is an elementary part of architecture, printing in a large scale, with different shapes and colours is getting more and more important.



ENERGY TRANSMITTANCE

G-VALUE

An important index for building physics is the energy transmittance value or g-value. It describes the energy transmittance of transparent building components and is the sum of direct transmission from solar radiation and heat output to the inside through radiation and convection. The g-value of ETFE can be influenced by printing thickness and type and varies usually between 0.2 and 0.9.

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