



Press Release

AWM carport roof with foil cushions made from 3M Dyneon ETFE generates electricity

Foil roof can support more than 50 tonnes of snow

The roof of this carport is very special. It generates electricity in the summer, withstands storms in autumn and will support more than 50 tonnes of snow load. Munich's waste management company AWM set high requirements when it came to the new roof design for its central carport. The roof area, covering nearly 8,000 square metres, is composed of air-filled foil cushions. The foil, which is made from the high-performance material 3M Dyneon ETFE, is so transparent that a photovoltaic system integrated into the foil cushions can generate up to 140,000 kWh of electrical energy per year. The roof is designed to withstand large snow loads, and requires virtually no maintenance owing to the incredibly smooth surface of the foil. A rain shower is sufficient to clean it.

If you don't have anywhere to shelter your car from the weather, you have to get up earlier in the winter to sweep away the snow. In the case of professional fleets of vehicles, this is not a productive use of time and leads to significant costs, especially in the case of large commercial vehicles. However, in its call for tenders for a new roof for the carport, which houses 140 vehicles, AWM was looking for something extra: the municipal

company has a commitment to sustainability in all areas of its business, at the same time aiming for the highest economic efficiency to keep waste collection fees down. The design by Munich architectural firm Ackermann & Partner met these requirements.

Using an existing pillar construction with a 10 x 12 metre grid, the architects designed a completely new roof structure. The roof skin is carried on triangular trussed girders mounted in the cross direction and has a high load-bearing capacity to support even extreme snow loads. The construction was carried out by Taiyo Europe a market leader in the planning and implementation of membrane architecture, based in Sauerlach, Bavaria.

Completely recyclable

The roof is made up of 220 three-layer foil cushions each measuring 3.30 metres by 10.40 metres. The foil layers – NOWOFLON® ET 6235Z extruded by Nowofol Kunststoffprodukte GmbH & Co. KG – are made from the high-performance material Dyneon ETFE. This material does not require the use of plasticisers during production and is 100% recyclable. These foils are increasingly being used in architecture because they provide a range of special properties: They are highly transparent and almost universally resistant to chemicals. In addition, they are largely maintenance-free as they are cleaned by rainfall. What's more, they have already proven their longevity with over three decades of use in a wide range of climates.

As thin as a human hair

Each of the curved foil cushions of the AWM Carport comprises an aluminium frame in which three layers of foil are tightly held. The load-bearing upper and lower foil layers are 250 micrometres thick. The middle foil layer is the thickness of a human hair, around 100 micrometres. The cushions are given

their characteristic shape using compressed air, which also ensures a high level of stability. Under normal weather conditions, the pressure in the cushions is 300 pascals which is around 0.2% of the pressure in a car tyre. In the event of a storm or snowfall, the pressure is increased to a maximum of 600 pascals. This is sufficient to safely support a load of up to 600 kilograms of snow per square metre. The blowers generating the compressed air are designed with dual redundancy so that even if two blowers were to fail, pneumatic support would be maintained. Even in the case of a failure of the entire pressure supply, the high loads specified would be held by the foils, which have a very high tensile strength.

Integrated solar cells protected from the weather

The foils, which are made from Dyneon ETFE, are highly transparent and allow more than 90 per cent of the sunlight to pass through. This is important because 12 flexible solar cells are mounted on the middle foil layer of each cushion, protected from the effects of the weather. A photovoltaic system covering 3,200 square metres has a peak output of around 140 kW and provides 1,000 kWh/kw_p of electrical energy per year, on average. The surfaces of the solar cells are protected by highly transparent UV resistant Nowoflon[®] ET 6235 Z film both on the front and backsides. To achieve a permanent and reliable bond to the cells, Nowofol put a special coating onto the ETFE films. This combination of ETFE cushions with ETFE covered photovoltaic cells provides weldability of the system which allows for maximum freedom of design. The solar modules, together with the printed lower foil layer, contribute to shading the carport in the summer, protecting it from exposure to excessive sunlight.

720 tonnes lighter than glass

Taiyo Europe constructed the entire roof structure in such a way that all the modules and elements can be replaced individually. The aluminium dual interlocking panel holds the lower foil layer and the middle foil layer with the solar cells together in one groove. The solar elements can be replaced easily by opening a separate clamping device that holds just the upper foil layer.

In total, the foil design weighs 720 tonnes less than a glass roof of the same size. This saves valuable resources and means that the steel beams can also be of considerably more filigree construction. The carport won the Engineering Prize 2013 of the Bavarian Chamber of Engineers. This prize is awarded for objects that use the latest technology and at the same time are visually appealing.

Neuss, 7th November 2014

About 3M

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About Dyneon GmbH

Dyneon GmbH, a 3M Company and part of the Advanced Materials Division, is a major supplier of fluoropolymers and is focusing on development, production and sales at its headquarters in Burgkirchen, Germany. The product portfolio of fluoroelastomers, fluorothermoplastics, Polytetrafluoroethylene (PTFE) and specialty additives, is available through the 3M sales organisation or representations in more than 50 countries. For more information please visit www.dyneon.eu

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Captions:

Image 1: The new carport roof of the waste management company Munich (AWM): the roof made of foil cushions generates electricity and withstands heavy snow load.

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Image 2: The films extruded from high performance material 3M Dyneon PTFE are largely maintenance free. Copyright: ©

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